The Journal of Diving History

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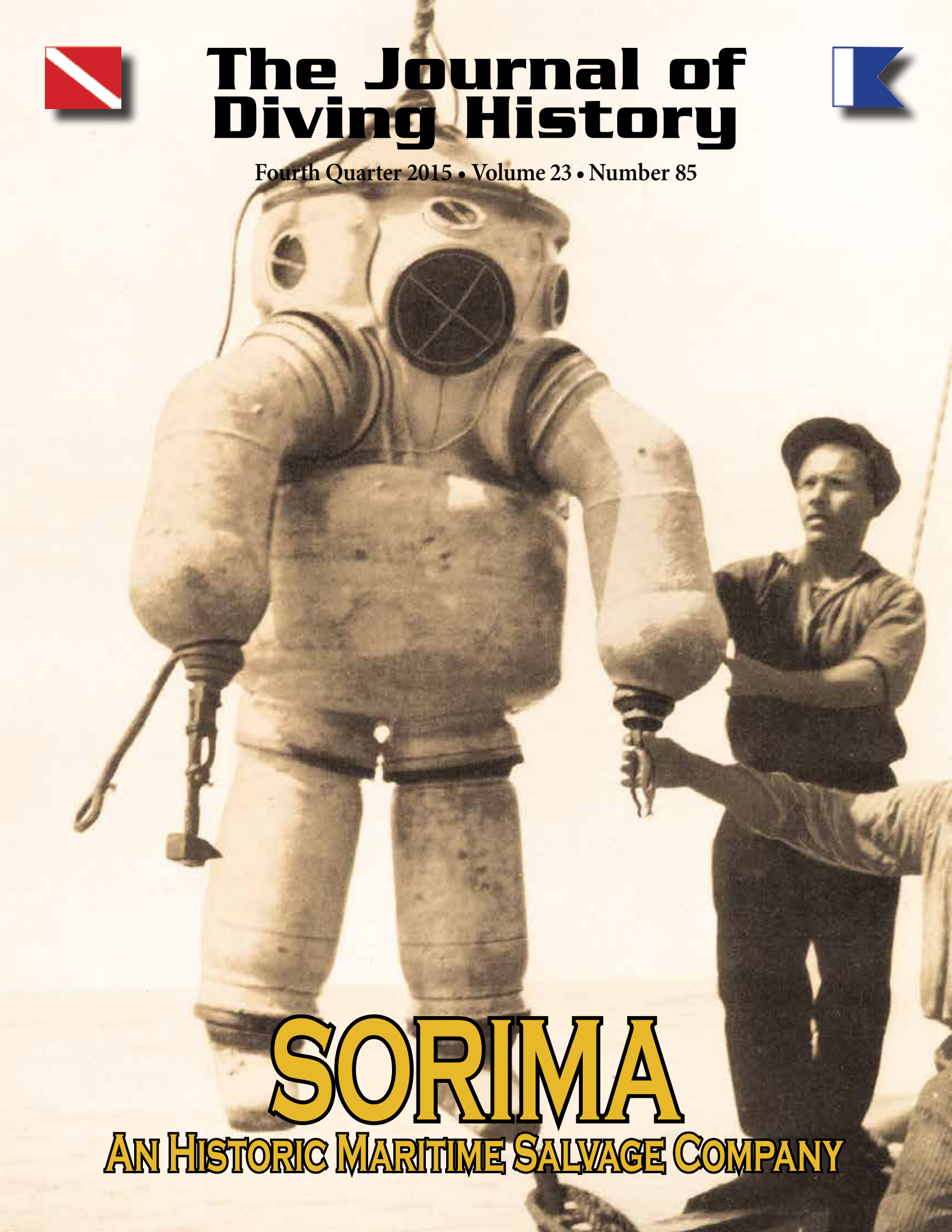

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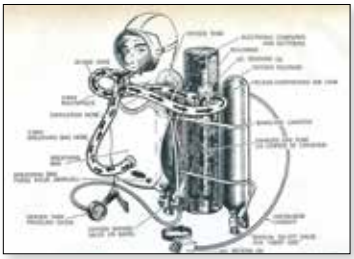
Features

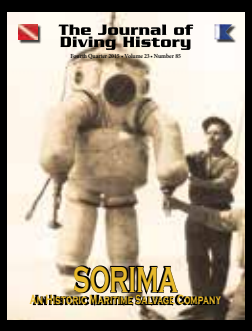


The modern day diver takes computerized equipment for granted, as it now the norm. One of the milestones on the historic computerized path to modern diving was the introduction of Walter Starck's Electrolung almost half a century ago. As this issue's Vintage Scuba column features Richard Walsby's excellent article on electrically controlled rebreathers before the Electrolung, we are republishing the original *Skin Diver* magazine article that introduced the Electrolung to the wider American recreational diving community. As the Publisher/Editor of *Skin Diver* magazine Paul had the diving experience and writing ability to present what the future of self-contained diving could look like. Here we are pleased to be able to present his full article complete with all the original images and captions.

Columns

This Issue

ON THE COVER
One of SORIMA's German Neufeldt & Kuhnke one-atmosphere diving suits used during the company's salvage operations.
Photo courtesy Jan de Groot



EDITORIAL

Farewell 2015

We close out this 2015 fourth quarter issue shortly after returning from the recreational diving industry trade show, DEMA, where the Society was involved in numerous activities, some of which are recorded in this issue by President Sid Macken in his HDS Quarterly Report. DEMA is a consistent highlight in the Society's year as the HDS staff and volunteers get to meet so many members who attend the show.

Kevin Hardy's extensive articles on the Golden Anniversary of SEALAB in the prior issues proved popular with many Society members who had worked on that program as either USN or civilian personnel. The issue was well received at Oceans 2016 in Washington D.C. and also at the Aquanaut Reunion in San Diego, both of which Kevin played a role in organizing. In this issue Kevin, and his colleague Ian Koblick, introduce the first of their new columns on the history of *Manned Habitats.* This issue also contains the last article in our series on *2015, The Year of the Military Diver,* but we are considering using those series of articles as the basis for a new column on Navy Diving that would be headed up by a former USN diver.

The main article in this issue is on the Italian salvage company SORIMA, and is one that we have been waiting to publish for some time. Our Dutch member, Jan de Groot of Nautiek, authored the article a few years back and it recounts salvage operations of 80 years ago using one atmosphere dresses and observation chambers. We wanted to introduce SORIMA during the same period that we had published articles on the technology of manned habitats and saturation diving, and these have appeared in recent issues of the *Journal.* The history of SORIMA and its achievements are kept alive today in Viareggio, Italy, by the Artiglio Foundation, which maintains ties with HDS Italia and HDS USA.

For members following the development of computerized diving we are happy to introduce Richard Walsby's article on electronically controlled rebreathers from the 1950's, and support it with a full reprint of the original 1970 *Skin Diver* magazine article on the Electrolung by Paul Tzimoulis.

This last issue of the year rounds out with our usual wide variety of historical information, which includes Sid Macken reporting on the reunion of the divers from Oregon's *Salvage Chief,* Don Creekmore reporting on a 1959 DESCO Mark V helium helmet built for a commercial company, Kees de Jong covers the Dutch Working Equipment Group divers operations, Chairman Dan Orr reports on the HDS GWS dive with Chuck Nicklin, plus our usual potpourri of history delivered by our knowledgeable columnists.

Happy New Year!

–Leslie Leaney, Executive Editor

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MARK YOUR CALENDARS.

The HDS is returning to the Pacific Northwest

September 23 and 24, 2016!

Photo Credit: Kevin Scott OKA

The Pacific Northwest has a unique and rich diving heritage and has been the home to two of The Historical Diving Society's best attended conferences. The Foss Waterway Seaport, a beautifully restored piece of Tacoma's historic working waterfront which is now a maritime museum and education center will be hosting the event. The Foss Waterway Seaport has close ties to Northwest diving and supports a significant display of diving equipment curated by The Flashback Scuba Museum.

The waterway is named after Foss family who operated a tug and barge business that worked closely with the McCray family on many marine salvage operations including the salvaging of the Diamond Knot. Tacoma was the site of two Cousteau expeditions and is home of Galloping Gertie, the collapsed Tacoma Narrows Bridge is the largest man made structure ever lost at sea.

2016 marks the 70th anniversary of La Spirotechnique/Aqualung. There will be exhibits showcasing the history of La Spirotechnique. There will also be special exhibits presented by The Flashback Scuba Museum, the new home of the world renowned Nick Icorn Collection. Newly restored and never before seen pieces from the Icorn Collection will be on display. The Northwest Diving History association will be presenting their work on preserving Northwest Diving History. Stay tuned for more details on this exciting event and a complete list of presenters. We look forward to seeing you in Tacoma.

Visit the Foss Waterway Seaport website at http://www.fosswaterwayseaport.org/

Photo Credit: Kevin Scott OKA

SORIMA

An Historic Maritime Salvage Company

By Jan de Groot

The SORIMA company was founded in Italy by Commander Quaglia on October 11th 1926, with the intention of salvaging valuable cargoes from sunken shipwrecks. Quaglia soon secured exclusive rights from the National Italian Insurance Company, to recover lost cargoes they had insured from depths of 45 meters, and deeper, in Italian waters.

Later that year Quaglia teamed up with a Frenchman named Terme, who had obtained French government permission for salvage work on 70 French ships sunk in Atlantic water during World War I (1914 – 1918). The terms were on the familiar "no cure - no pay" basis, with 10% of the salvaged value going to the French Treasury.

The SORIMA fleet.

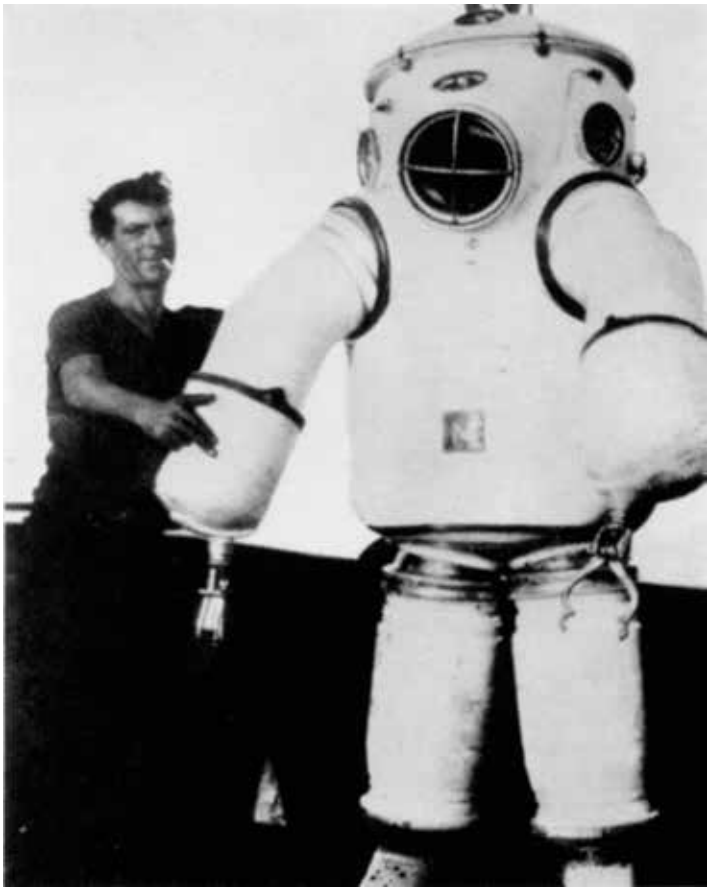
The original SORIMA fleet consisted of the four former steam trawlers, *Artiglio, Rostro, Raffio* and *Arpione.* As will be read, the *Rampino* and *Rastrello* were added later. It is interesting to note that all of the ships names corresponded to limbs or instruments used for grabbing at objects. For example, *Artiglio*, which was the largest vessel in the fleet, means "talon" in Italian. All of the vessels were equipped with heavy derricks, extra winches, an extensive anchoring system, a large cargo hold for the salvage equipment, and a storeroom.

The crews of the SORIMA ships consisted of deck and engine room personnel, recruited mostly from the area around Genova in northwest Italy. These crews were complimented by experienced helmet divers, many of whom came from the coastal town of Viareggio, to the south of Genova and La Spezia. SORIMA established some long-lasting staffing contracts with its personnel, who in turn gained considerable experience working in difficult and challenging circumstances.

Diving equipment and salvage methodology.

The salvage depths that SORIMA would be working were generally going to be beyond the safety limits for traditional helmet diving operations, which would all be carried out on air. Therefore the company would have to use newly developed one-atmosphere diving suits (ADS), which would be supported by underwater observation chambers to direct their operations. The divers in both these systems would remain at atmospheric pressure and, irrespective of their operating depth, they would have no requirement to decompress.

The diver in the observation chamber had a direct telephone connection to surface dive supervisor on board the mother ship. He would give guidance and instructions to the dive supervisor, who would in turn relay them to the diver in the ADS, allowing them to accurately place explosive charges on the target wreck. Once the successful underwater blasting of the wreck had been accomplished, parts of the



Neufeldt and Kuhnke 3rd generation armoured dress

The 3rd generation armoured dress

The *Artiglio* recovering debris from a wreck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Anno XXXII — N. 51 — 21 Dicembre 1930 - Anno IX — Centesimi 30 la copia

L'"Artiglio", che aveva recuperato tanti tesori naufragati, giace ora in fondo al mare. Un piroscafo francese, che col suo carico di esplosivi era stato affondato durante la guerra nelle acque basche, è esploso durante il recupero: l'"Artiglio" è stato travolto nella spaventosa tromba d'acqua. I tre famosi palombari Alberto Gianni, Aristide Franceschi e Alberto Bargellini e altri nove uomini dell'equipaggio, compreso il capitano, sono periti.

salvage operations, the armored ADS diving suits and observation chamber were later improved by Gianni and Roberto Galeazzi. The company founded by Mr. Galeazzi also produced some very highly acclaimed diving helmets, which became the Italian Navy's standard diving helmet. The company is still in operation today and manufactured the 20 special Galeazzi Marina helmets for the HDSUSA's 20th Anniversary in 2012.

During salvage operations at sea, the observation chamber was used in preference to the ADS for initial wreck surveys, as experience indicated that tidal movement made it difficult to keep the latter in a stable position. For this work the observation chamber also had more advantages, as it had view-ports all around and a ballast weight that could be released in an emergencies. Essentially, the ADS was reserved for jobs for which the observation was unsuited.

Additional tools included a powerful electric underwater lamp and an electromagnet, which was useful for removing debris and retrieving any cargo grabs that became detached during the work. For diving work in shallower waters, the SORIMA ships were also fitted out with the traditional standard helmet diving equipment.

Activities in the Mediterranean.

The first salvage challenge for SORIMA was in 1926 when they began salvage work on the steamship *Washington*, sunk in 90 meters, two miles off the Italian coast. In an operation spanning three years 7,000 tons of cargo, including steel, copper, 300 railway cars and seven locomotives, were recovered and sold. It was work that received the acclaim of salvage experts around the world.

During the autumn and winter of 1929, SORIMA went on to recover 450 tons of copper and 200 tons zinc from the wreck of the *Primo*, lying at Cape Palos in a depth of 75 meters. They followed this in the spring of 1930

wreck and the cargo itself were recovered and lifted back to the surface using a mechanical grab or electromagnet.

The first ADS suits that Commander Quaglia purchased were second-generation Neufeldt and Kuhnke suits, made at the company's head quarters in Kiel, Germany? Later, in close cooperation with SORIMA's chief diver Gianni, Neufeldt and Kuhnke went on to develop a third, better looking, and less vulnerable, model of ADS.

Gianni was a very ingenious and versatile man who had already designed the observation chamber. This was a cylindrical pressure resistant apparatus that had view ports, and which the diver could be enter via a hatch cover on the top. Divers in both the ADS and the observation chamber were provided with a closed circuit oxygen breathing system, together with the telephone system previously mentioned. Based on practical experience gained during a number of


Chief diver Gianni preparing explosive charges

by salvaging large quantities of wool and tallow from the wreck of the steamship *Ravenna*, sunk in 90 meters in the Bay of Genova.

Activities in the Atlantic.

In the summer of 1928 the *Artiglio* headed for the French Atlantic coast, where the sea conditions were more hostile compared to those of the Mediterranean. Their first target was the wreck of the steamship *Elisabethville*, from which they hoped to recover the safe from the post room, where diamonds were supposed to be stored. Having located the wreck by sweeping a steel cable slung between two vessels, they blasted areas of it to gain access, but could not find the post room safe.

The safe in the captain's cabin was recovered however, but did not contain anything of importance. It was later discovered that the diamonds had never been aboard the ship, and eventually all SORIMA managed to salvage were some boxes of ivory elephant tusks, the sale of which just covered their expenses. However, this first experience battling the conditions in the Atlantic taught SORIMA that some of their equipment, especially the anchors and mooring systems, had to be improved to content with tidal currents and swell.

The *Egypt* disaster.

The *Egypt* was a P&O liner of 8,000 tons, built in 1897. It left London on May 19th 1922, for Bombay, India, with 294 crewmembers and 44 passengers, although more were to board at Marseille. She also carried seven tons of gold in bars and 40 tons of silver in bars and coins, in a hold deep in the ships bowels.

On the evening of May 20th the freighter *Seine* collided with her in a dense fog off the French coast, some 25 miles south-southwest of Ouessant. The *Egypt* was hit amidships on the port side and sank within 20 minutes, with the *Seine* succeeding in rescuing 250 passengers and crewmembers, while all the others were lost. Based on SOS-signals that were sent out, and received by two radio stations on the French coast, it was possible to establish a rough position of the incident.

The *Egypt*, search and discovery.

As insurers, Lloyds of London paid out for the ship's loss and then went on to plan a salvage attempt. This planning fell to a Mr. Sandberg, a well know consultant, and it was agreed with the International Salvage Union (a subsidiary of Lloyds) that his company should make a salvage attempt.

Their first step was to find the wreck, and they contracted a Swedish salvage company to undertake the search. In 1923, after two months of searching, captain Hedback of the Swedish salvage vessel Fritjof thought that he had finally located the *Egypt* near the position of the bearings taken from the SOS-signals.

He was wrong.

Whatever the wreck's true location the water depths of the area precluded the use of helmet divers. Originally Mr. Sandberg had intended to design a special underwater device to help with the salvage, but this never materialized. Consequently, in the autumn of 1925, a second contract was signed with the Salvage Union, Mr. Sandberg, and the French Union d'Entreprises Sous-Marines (owned by Mr.Terme) to salvage the treasure.

German divers, using Neufeldt und Kuhnke ADS armored diving suits, were used during the summer of 1926, but without success. It was then decided to make a third attempt and, on August 8th 1928, a contract

Preparing to dive in the Observation chamber. Note the mask, telephone, corrugated tubes and the carbon dioxide absorbent cannister

Jubilant crew of the *Artiglio* after the first discovery of gold on the *Egypt*

Quaglia (standing right) with Capt. Raffaelli Seduti with divers Sodini, Lenci and Mancini and some of the gold recovered

was signed with SORIMA. From the June 1929 their vessels *Artiglio* and *Rostro* began sweeping operations. Several times the cable struck objects, which on investigation turned out to be pieces of rock. As the weather conditions that summer were particularly bad, it was decided that the *Rostro* should return to the wreck of the *Elisabethville*, with the intention of salvaging more ivory and to make a fresh attempt at finding the diamonds.

The *Artiglio* was now equipped with a galvanometer and tests carried out on known wreck sites to both test and calibrate it. The results were not that good and, as the weather conditions were worsening, Quaglia decided to stop the search operations for the winter period and resume them in 1930.

It was the beginning of June 1930 before the search was taken up again, further investigations having indicated that the *Artiglio* and *Rostro* should concentrate on a search area of six by 10 miles. The prior method of sweeping by using a wire 900 meters in length slung between the two ships was improved upon by using buoys to keep the sweep wire off the seabed. Even so, the wire still got struck on various objects a number of times, all of which had to be investigated by divers. Then, on the August 30th, more or less by accident, when a buoy that had drifted away was recovered and lifted, some metal was found to be entangled in its bottom weight. This metal appeared to be a small davit which, from the original ship's drawings, appeared to belong to the *Egypt*. After the divers had examined the location, it was concluded that they indeed had found the wreck, which was upright on the sea bottom. In a mater of days other objects were recovered, including a large hydraulic davit and the safe from the captains cabin which, on opening, did not contain anything of value.

Now that the wreck had been located, it became necessary to reach agreement with a number of different authorities, organizations and individuals, regarding their respective share of and revenue from the potential salvage. This all took time and, with the onset of winter and deteriorating weather conditions, it was decided to redeploy the SORIMA vessels on other work in more sheltered waters.

The loss of the *Artiglio*.

At the beginning of October 1930 the *Artiglio* and *Rostro* began working on the wreck of the steamship *Florence H*, which had been sunk by an explosion while at anchor a few miles outside the locks of St. Nazaire. As the entrance to this harbor was rather narrow, the wreck, which contained ammunition, had to be cleared.

The SORIMA crews, using their usual safety standards, began blasting the wreck with small charges. When the charges did not produce the desired results, they were increased, but again failed to produce the desired results. As the size of the charges were increased, the *Artiglio* was moored closer to the wreck site. On December 7th, after the standard helmet divers had placed charges and returned on board, both vessels moved approximately 300 meters away from the wreck. The usual warning signals were made, the wires to the explosive charge were connected, and the detonators ignited.

The result was a tremendous explosion followed by an estimated 300 meter-high column of water and debris which was blasted into

Paper money (Rupees) recovered from the *Egypt*

A sovereign recovered from the *Egypt*

the air. A moment later the *Artiglio* simply disappeared beneath the water. The Rostro rushed in and saved seven of the *Artiglio* crew, and recovered four bodies including Gianni. Sadly eight of their SORIMA comrades were permanently lost.

The *Egypt* salvage.

From both a material as well as a human point of view, the loss of more than half of the crew and the *Artiglio* was a savage blow to SORIMA. Yet, despite this disaster, Quaglia decided to continue recruiting new crewmembers, and bought an old steam trawler, which was somewhat bigger than the lost *Artiglio*. It was overhauled, fitted out with the steel mast, main winches and derrick, all of which had been salvaged from the sunken *Artiglio*. This new addition to the SORIMA fleet was named *Artiglio II*.

The ship was ready by May 4th 1931, but two days later fate again struck the company when the *Raffio,* which was working on another wreck, capsized and was lost. Fortunately the crew, with the exception of one stoker, survived and clambered into the workboat. These survivors later joined the crews of *Artiglio II* and *Rostro.*

On June 6th the *Artiglio II* left harbor, but bad weather forced her to return. Only by the 13th had the sea become calm enough for her to put out six anchors and position herself directly over the hold of the *Egypt.* The place where the gold and valuables were stowed was deep in the wreck, three decks down and in a storeroom measuring 8x2.5x3 meters.

To reach it the ship's structure had to be blasted apart using explosives, and the ensuing debris was removed using a grab. By June 30th it was reported that the divers were within approximately 5 meters of the storeroom and, by the 6th of July, this had been reduced to 2.5 meters.

Unfavorable weather conditions then made it impossible for them to reach their goal, and it was only on August 15th that they reached the deck above the storeroom. It now became necessary for them to remove a lot of debris to create a suitable space, before carefully removing the final deck and gain access to the storeroom proper.

Again the salvors were plagued by extreme weather circumstances and it was November 17th before the first diver could be lowered down to the wreck in the observation chamber. He reported back that the space was still intact, but by the beginning of December it was decided to postpone further work until the spring of 1932.

In May 1932 the *Artiglio II* returned to the wreck, and the first task was to remove any debris that had fallen onto the deck above the storeroom during the winter.

A political joke from Punch showing British Prime minister of the day Ramsey MacDonald inviting 'the Artiglio,' in fact 'the Artiglio II,' to come and sort out Europe at the Geneva talks

Recovered coins and bars

The deck was then penetrated and on June 9th the first piece of a wooden box, of the type in which gold was packed, was recovered. The next day some packages with Indian rupee banknotes were brought to the surface, but it was June 22nd before the first gold bars were recovered. These were soon followed by more bars of silver and gold over the next few days.

At the request of the French Ministry de Marine, *Artiglio II* and *Rostro* were then mobilized to investigate the fate of the 92-man crew of the submarine *Promethee* (length 92 meters and built in 1930) that had sunk on July 8th in the English channel. Using the articulated ADS suit, the SORIMA divers reached the wreck but there was no response to their tapping on the sunken hull, the conclusion being that there were no hope of any one surviving the sinking. A further investigation using the observation chamber then concluded that it was impossible to salvage the submarine with the techniques currently available.

Salvage operations back on the *Egypt* were interrupted by long periods of bad weather, although they stayed on site until late October, arranging their buoys to conceal the wrecks exact location before leaving until the following season.

Work on the *Egypt* began again in the spring of 1933 and it soon became apparent that fewer objects of value were being recovered. This was because these were scattered around the storeroom, which was by now partially filled with sediment, and the size of their grab made it impossible to pick up smaller objects. To solve this problem, a vacuum grab was developed, fabricated, delivered to the site, and which proved very efficient at sucking up smaller coins from areas in the wreck. It was not however, possible to recover the complete cargo before the winter storms set in. In 1934 the *Artiglio II* returned in to finish the salvage and in total seven tons (98%) of the gold bars and almost 40 tons of silver bars, including around 90 % of the silver coins were recovered. An excellent performance, considering the tragedies and difficulties they had endured.

The final return, of approximately one million pounds sterling, was divided between the insurers, at 37.5%, and the balance between the participants in the salvage operations.

SORIMA activities until 1939.

During and after the salvage activities on the *Egypt* the other vessels of the SORIMA fleet were involved with different cargo recoveries off the French coast and in the western approaches to the English Channel. It is beyond this article to delve deeply into all these activities, but large quantities of ferrous and non-ferrous materials (copper, brass, aluminum, tin, zinc) and general cargo were recovered from around eight wrecks, and sold on the open market. During the winter season, when *Artiglio II* could not work on the *Egypt,* she took part in salvage work on several wrecks lying in more sheltered waters.

Around the outbreak of the Second World War in 1939, Quaglia decided to leave the Atlantic area, and A*rtiglio II* and *Arpione*

Grab with safe from captain's cabin, September 5, 1932

Boxes with recovered gold bars discharged in England August 30, 1932

Mario Raffaelli, the Chief Diver and Salvage Officer, coming up in the observation chamber from an inspection dive on the *Egypt.*

Cdr Quaglia with first recovered gold bars

returned to Italy, followed a month later by the *Rostro* on September 16th. Alas there is no information available about the activities of SORIMA during World War II, except that *Artiglio II* was sunk as a block ship in one of the Italian ports.

SORIMA activities 1945 - 1956.

Artiglio II was refloated in 1945 and refurbished, and together with the *Rostro* and a new *Raffio,* this brought the SORIMA fleet up to full strength. Immediately after the war the company was involved in salvage work along the Italian coast, though plans were made to resume activities in the Atlantic.

In 1948 a modern steam trawler *Scalpay,* which had been built in 1942, was acquired. Equipped with an Asdic system, it was now possible to carry out more effective searches for wrecks that SORIMA still wished to work on. Together with the wreck of the original *Raffio*, over ten wrecks were located in the Bay of Biscay, but although, they were the wrecks the company were looking for, it was considered that none warranted salvaging. During 1950 SORIMA decided to move ships more northward, where two wrecks were found and buoyed ready to be worked the following season.

Of the older SORIMA vessels the *Arpione* was written off in 1951, while the *Rostro* was replaced by a more modern vessel, the *Rostro II,* which had been built in 1941. During 1951 the *Scalpay* located another two wrecks, which proved enough to occupy *Artiglio II, Raffio* and *Rostro* with satisfying results. Then in 1952, the *Scalpay* located a wreck that was believed to be the North Cambria, with a cargo of 2,600 tons of copper and tin.

SORIMA had began recovery work before it was discovered to be another wreck, the salvage rights for which the British Government had already granted to another salvage company, Risdon Beasley Ltd. In the end, both companies reached an agreement and SORIMA continued its recovery work on the understanding that the revenues would be shared.

In May 1953 another wreck was located, which was definitely the *North Cambria.* Work on her by *Rostro* was, however, delayed until the August, while attempts were made to salvage valuables from the *Flying Enterprise*, an American Liberty ship that had sunk in January 1953. Eventually, after two months working with grabs on the *North Cambria,* the results proved to be disappointing so *Rostro* and *Scalpay* spent the rest of the season searching for other useful wrecks.

During 1954 salvage activities were carried out on a number of wrecks, but the company revenues decreased, mainly due to a drop in the price of raw materials. They appear to have been a forerunner for dramatic events that would take place during 1955, when Commander Quaglia died and his chief salvage officer suffered a severe heart attack. Despite attempts to continue the SORIMA company ceased operations in 1956.

The Artiglio Foundation

The Artiglio Europe Foundation was created in Italy on the initiative of the Rotary Club di Viareggio Versilia. It took its name from SORIMA ships of that name which, with divers from *Viareggio* on board, earned universal acclaim for their recovery achievements in the Mediterranean Sea and Atlantic waters between 1920 and 1940.

The Foundation has several activities including

- the collection of information
- publication of books, films, DVD's etc.
- the collection, preservation of artifacts and their display in the local shipping museum
- co-operation with relevant national and international shipping museums
- the restoration of the observation chamber designed by Gianni
- promotion of the commemoration ceremony
- organization of meetings and seminars

More information can be found on their website at www.artiglio.org

The Premio Internazionale Artiglio 2007.

Since 2001, in every alternate year the Foundation has organized a seminar, during which any new available information about the Artiglio is presented and awards made which to acknowledge and honor persons, corporations and organizations who have made important and original underwater exploits, on both a national and international level.

In 2007 year the Premio Internazionale was granted to Mr. Hans van Rooy, managing director of Smit Salvage, a Dutch company considered to be the largest company in the world in its field. The decision of the Board of the Foundation was based on the excellent and innovative achievements that this company which, among others things, salvaged of the Russian nuclear submarine Kursk in the Barents Sea and the recovered of the Japanese fishery training vessel Ehime Maru from 600 meters in the Pacific. Other awards went to: Jean Le Garrec, former vice president of the French National Parliament, the Italian Radio and Television Broadcast Company and The Italian Historical Diving Society.

Premio Interazionale Artiglio plaque

Sources and acknowledgments

Claude Rabault: l'Or et la Griffe
Allan C. Crothall: Wealth from the Sea
David Scott: Seventy Fathoms Deep and The Egypt's Gold
Robert Davis: Deep Diving and Submarine Operations
Roy Martin & Lyle Craigie Halkett : Risdon Beazly Marine Salvors
Robert Stenuit: l'Or a la Tonne
The Artiglio Foundation: various publications
A special thanks goes to Mr. Boris Giannaccini, Dr. Francesco Sodini and Prof. Marco Fabrizio Saettone of the Artiglio Europe Foundation for their kind cooperation.
Pictures: Archives Artiglio Europe Foundation and the author's personal archives.

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Presentation of the Premio Interazionale Artiglio Premio Internazionale 2007 to Mr. Hans van Rooy, managing director of Smit Salvage

Celebrating the Year of the Military Diver

Davy Jones's College from *Popular Science,* March 1944

This four-page pictorial article centers on the US Navy program at Pier 88, which trained divers for the numerous salvage operations that were required as World War II ground on. The article was published three months before D-Day, June 6, 1944. The training on Pier 88 was carried out on the French luxury liner the *SS Normandie,* which had been seized by the USA during wartime and rechristened the *USS Lafayette.* The vessel had sunk at Pier 88, which is now the site of the New York Passenger Ship Terminal. The US Navy Mark V was the helmet system used at the school and the models seen in the photographs show the wear and tear associated with the helmets constant use by a constant stream of students. The Pier 88 School produced many divers, some of whom, like Leonard Greenstone, went on to distinguished careers in civilian professional diving after the war was over. Some of the USN Mark V equipment produced during the war was later sold as War Surplus, and acquired by ex-USN divers who had entered the post World War II commercial diving market.

– Leslie Leaney

In a water-filled glass tank, a student diver goes to work on a piece of metal with an underwater cutting torch, while his instructor carefully watches every movement to see how well he does the job

DAVY JONES'S COLLEGE

Photographs by ROBERT F. SMITH

Underwater assignments train Navy divers for the difficult, dangerous work of salvage.

AN INTENSIVE, 14-week training course turns ambitious young carpenter's mates, steam fitters, and machinist's mates into "underwater mechanics" at the Navy's diving and salvage school, Pier 88, North River, New York City. More than 400 bluejackets now enrolled, and 50 more volunteering every two weeks, will help fill the pressing need for men who know how to raise sunken ships all over the world. Diving assignments from moored floats, in water so murky that a student must work by sense of feel, apply classroom lessons. Photos on these pages show some of the exercises that novices learn to perform. Eventually they become able to open and close valves and repair piping in a vessel on the bottom, and to apply patches and bulkheads of many types.

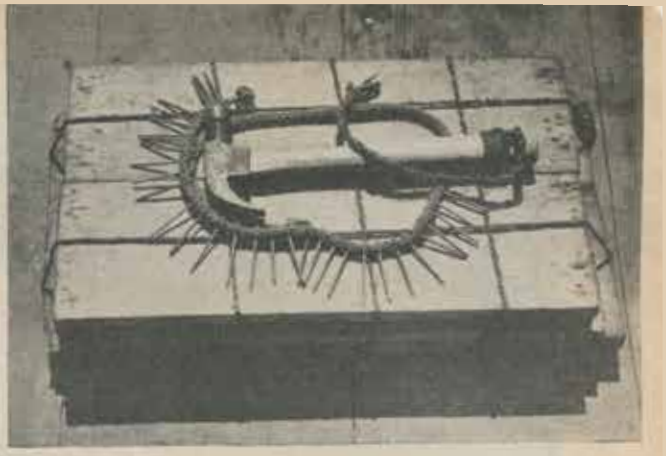
USING A HACKSAW. Diving itself is only part of a diver's job. The important thing is for him to know how to handle tools and make repairs once he has been lowered into the water. The pictures on this page are above-surface photographs of some of the jobs he may be called on to do—often in water so murky that he cannot see, and must rely solely on his sense of touch

REPAIRING A PONTON. A ponton with a leaky gasket is tossed overboard. A student diver goes down, locates it, changes the gasket, affixes an air hose, and comes up. His instructor turns on the air valve. If the ponton bobs to the surface, the student "passes." If it doesn't, he flunks—and takes another dive

CONTINUED

CONNECTING A PIPE FLANGE is another common diver's job. Young Navy carpenters and machinists are now volunteering at the rate of 25 a week for the hazardous job of practicing their trades under water. Physically, they must be able to withstand great pressures. Emotionally, they must be able to overcome that first terrifying sensation when locked into a diving suit

A PIPE-FITTING JOB. Working on a muddy bottom into which he may sink, a diver, by regulating intake and exhaust valves, can reduce his buoyancy slightly, and then half swim, half wallow his way along. Or he can increase his buoyancy slightly and walk on the bottom in a sort of light-footed dance

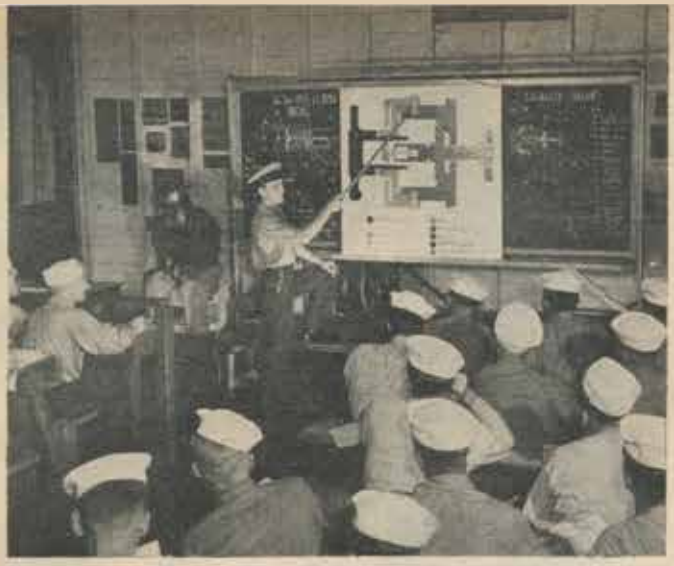


Materials for the box consist of bottom and side pieces, nails stuck through a short rope, and a hammer with lanyard to be tied to diver's wrist

BUILDING A BOX UNDER WATER is one of the easier jobs student divers are called on to perform. This diver, ready for the plunge, is handed his materials securely tied. He then goes down to a metal workbench suspended 20 feet below the surface and starts building the box. Assembling the parts and driving the nails are not so tough. The real trick is to keep the wooden pieces from "getting out of hand," for once they do that they will start to float upward, and the next instant be out of reach. Right, diver comes up with completed box tightly clutched in hand

DRILLING with a power-driven auger or jackhammer isn't an easy job even on dry land. Yet divers must be able to operate these tools at deep-sea levels. In the pictures below (simulating underwater views), the diver at the left is shown drilling a block of concrete. At right, boring holes in a piece of lumber. Metal stages, swung from cranes, are used by salvage boats to lower divers and their equipment over the side. Toughest and most important job a diver can do is to go down into murky water to inspect a wreck. Groping his way inch by inch over the damaged area, letting his fingers do the work of his eyes, he must then be able to come up and show what repairs are needed in an accurate sketch that can be used in planning the best salvage method

DIVING SCHOOL (continued)



CLASS WORK. Here an instructor explains the operation of the chin valve, an important part of the diver's helmet. How well these students learn their lesson may some day prove to be a matter of life and death to them

A DIVER'S TORCH uses the intense heat of hydrogen burning in oxygen, each gas being supplied by a hose. A third hose furnishes air that forms a protective bubble around the flame

A DIVER'S HANDLERS DRESS HIM FOR THE DEEP

1. Preparing for a dive, this student works up a good soap lather on his hands. This prevents his wrists from becoming chafed by the sleeve cuffs and also aids in preserving a watertight seal. 2. To make sure he doesn't bob to the surface because of insufficient weight, a diver must hoof it in 34-pound iron shoes

3. Here the breastplate has been bolted in place. One of a diver's difficulties is having to work in a suit that very often weighs more than he does. 4. To the top of the breastplate is screwed the all-important helmet. When lines have been given a final adjustment, faceplate is closed—and down he goes

Homemade Housings: Ingenuity on the kitchen table, Part II

By Sid Macken

Early on in recreational and commercial diving if you wanted to build your own underwater camera housing it was essential to know the elements of design which would protect your camera from water and resist water pressure. For many home craftsmen/divers that knowledge came from early books on recreational diving. Rick and Barbara Carrier included housing construction in their book, Dive, as did John Cayford in Underwater Work. There were others, but only a few early authors wrote specifically for the underwater photographer. Hilbert Schenck and Henry Kendall wrote the first American book on recreational scuba diving in 1950, Shallow Water Diving for Pleasure and Profit. That early work included a section on building an underwater housing out of a hot water bottle. They later produced a first (1954) and second (1957) edition book titled Underwater Photography. This

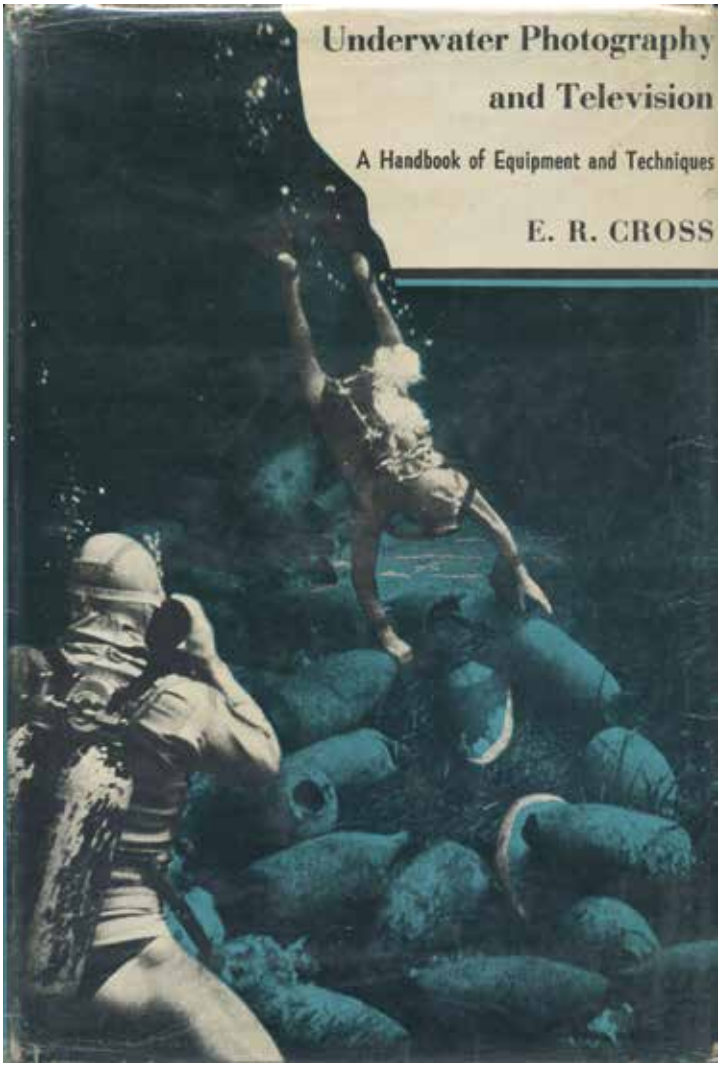
The author's housing built for Bolex movie cameras

book went much more in-depth about underwater photography generally, but also into housing construction. Also, in 1954, E. R. Cross published what was at that time a very technical book, Underwater Photography and Television. Cross's book, likewise contained detailed references to housing construction.

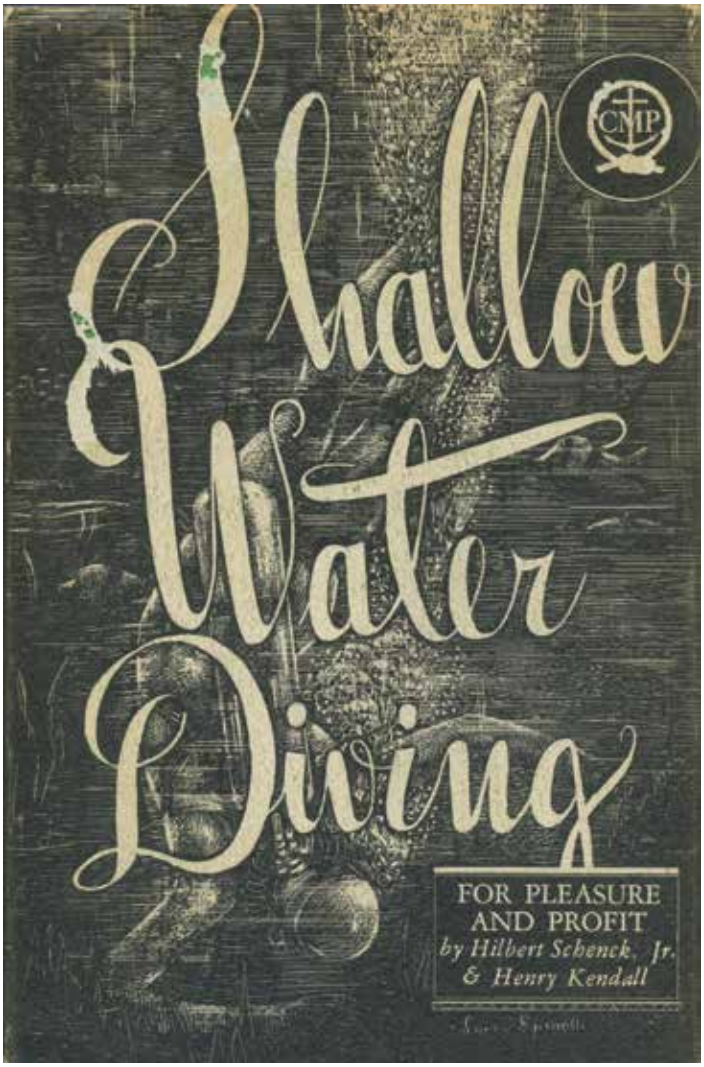
The author who probably reached more underwater photographers than any other was Mart Toggweiller, and he did so with a humble little paperback book with a very long title, How to Build Your Own Underwater Camera Housing. In a 2005 telephone interview, Mart told me that he had 10,000 copies of both the first and second editions of his book printed. At the time of the interview, he had 300 copies left. The single edition of Cross's book, by comparison, had a print run of 2,500 of which, Cross once told me, half went into a landfill because they did not sell. Mart's small book, at $1.00 for the first edition and $1.95 for the second, had the potential of reaching over 19,000 underwater photographers. Since the book shows up at online auctions from as far away as Australia, his reach was also international. Through his mail order business, originally named Dive Rite but later changed to Hydrotech, Mart provided the material and parts for building housings. From Mart, the budding underwater photographer could purchase Plexiglass sheet and cylinders, O-rings, O-ring sealed control shafts, lead handles, and other odds and ends needed to complete a housing. Following the instructions in the book, a housing could be built for around fifty dollars. Not a bad price when commercial housings could run several hundred.

Other companies such as Mar-Vel, Aqua Craft, and Ikelite sold camera housing parts and supplies for a time, but eventually dropped them from their catalogs. Only Toggweiller's business was, and remained throughout its existence, dedicated to the do-it-yourself camera-housing builder.

The Plexiglass housing shown with this article is one of a pair this author built to house Bolex H8 and H16 movie cameras.



E. R. Cross's technical book on underwater photography and television included housing fabrication instructions

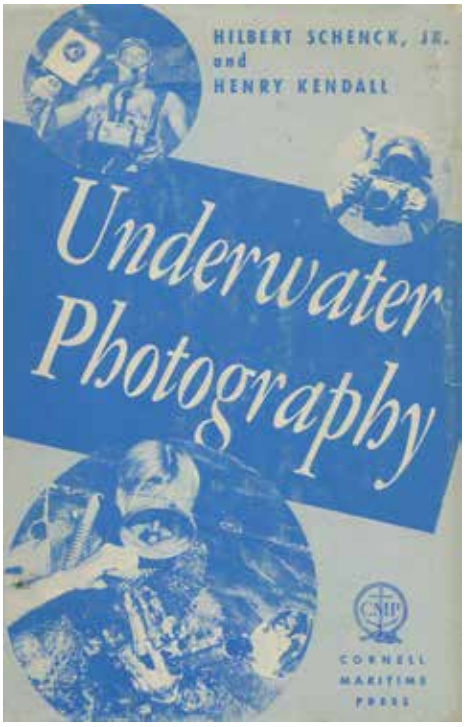


America's first book on recreational diving included how-to instructions for building a simple underwater camera housing

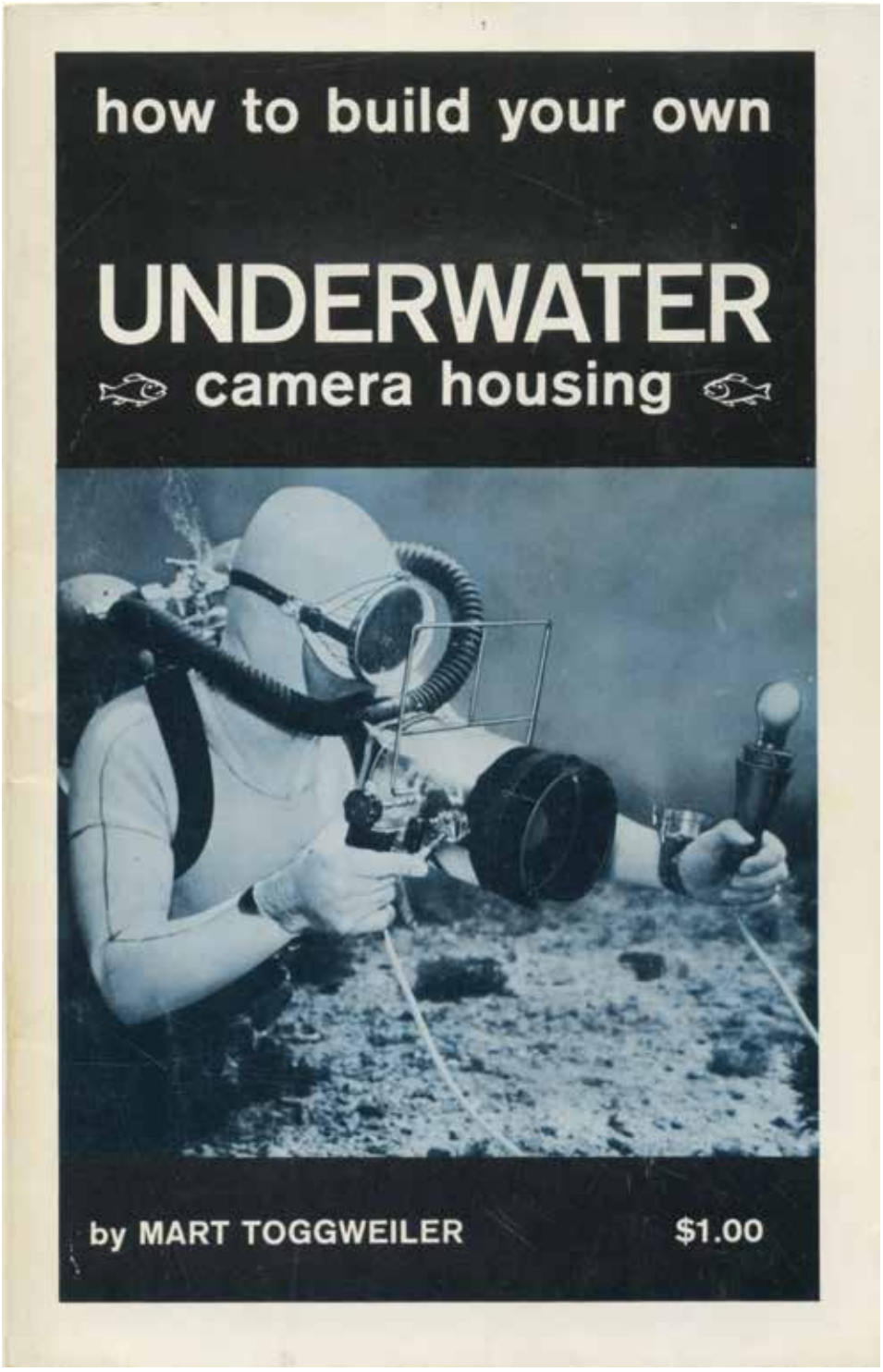
The shell of the housings were formed by Mart to fit closely around the cameras. The housing was completed at home by adding the side plates, controls, handles, and camera supports from parts and material purchased through the Hydrotech mail order catalog.

The do-it-yourself era of diving equipment is mostly a thing of the past; however, there was a time when homemade equipment was the mainstay of underwater photography. Many of the early commercial manufacturers of underwater photographic equipment and professional underwater photographers got their feet wet while building and using homemade gear.

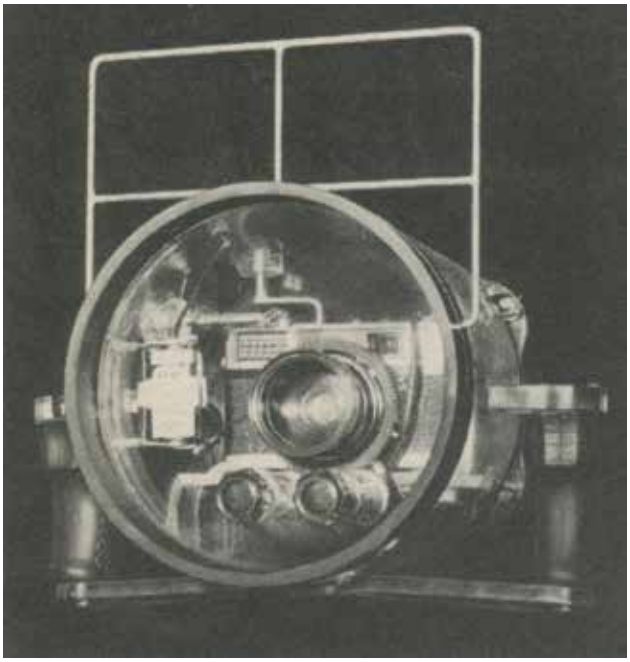
Photo Credits
All photos by the author



The first edition of Underwater Photography was published in 1954 with much more elaborate instructions for housing construction



How to Build Your Own Underwater Camera Housing probably reached more underwater photographers, worldwide, than any other book on housing construction



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Illustrations from Mart Toggweiller's book along with order forms for parts

DESCO US Navy Mark V Helium Helmet

Milwaukee, Wisconsin
Serial number 188, date 1-29-59

By Don Creekmore

As would be expected, the HDS did a wonderful job in documenting and celebrating the 100th anniversary of the US Navy Mark V helmet in 2015. One of the beauties of the Mark V is its consistent appearance and construction details, with only a few minor exceptions during its 100-year history. Morse and Schrader started production during WWI and DESCO and Miller Dunn started manufacture during WWII. Of these four companies only DESCO still manufactures the helmet today.

During that century of manufacture each company had their own unique traits that can be found on these helmets, but for the most part however, a Mark V from 1918 will look the same as one from 1978. The Mark V's big brother, the helium Mark V was no different, or so I thought. Manufactured during WWII by DESCO, the US Navy Mark V helium helmet is an impressive piece of equipment and was produce in far fewer numbers than the standard Mark V.

The use of helium allowed for deep dives beyond the safe range of air, and the plumbing required for the system to operate was a cornucopia of hose, communication, electrically heated under suit and canister connections. Weighing in at over 90+ pounds with a large brass canister on the back, this helmet looks like something an Apollo astronaut would have used. One of my favorite diving books is *Navy Diver* by Sidney Karneke, as it features an entire chapter, titled *Hell Fire and Deep Water*, on using the helium Mark V.

The helium Mark V used a chemical absorbent called Shell-Natron in the rear brass canister. This chemical would absorb carbon dioxide from the helium oxygen mixture supplied to the helmet. A drawback to using this chemical is that if it came into contact with any amount of water came it

produced toxic fumes that could be fatal to the diver. Over the years we have found a few of these helium Mark V helmets and they have all been constructed in the same style with the same attachments. The US Navy had their specifications for how these helium Mark V's were built and the US government was just about the only customer that needed such a specialized, and expensive, helmet. Or so I thought.

In the summer of 2015 we had the good fortune of being able to purchase a helium Mark V from one of the early pioneers of the commercial deep diving oil field industry. At first glance this helmet looked like a normal helium Mark V but upon closer inspection we saw it had some differences.

The helmet was made in 1959 by DESCO and was completely un-modified and had matching serial numbers. The first detail that was different was the lack of an eyelet on the peak of the bonnet. Secondly, the exhaust on this helmet was noticeably different from the USN standard as it was the original unmodified design of exhaust that was used throughout WWII. This was a standard style banana exhaust that stretched over the top of the bonnet and terminated with the normal Mark V perforated bowl at the back of the helmet, as seen in the photos. Sometime after WWII he US Navy ordered this standard exhaust be modified and the perforated bowl be replaced by an exhaust valve located on the crown of the helmet.

After studying the helmet and realizing it was unaltered and in its original configuration we contacted DESCO. While their records from the late 1950's are incomplete they did confirm the helmet is original, and indicated that the helmet was probably a special order by a commercial diving company. This seemed logical to us as the man we acquired it from was involved in early commercial helium diving. Possibly to save a little money, the company left off some of the features such as the exhaust modification and eyelet on top. Personally, the missing eyelet would not bother me, but for a helmet with a reputation as a widow maker, that exhaust modification might have been worth the few extra bucks!

Regardless of the frugality of the original buyer, the puzzle of this helmet's configuration were starting to come together. While the seller of the helmet did not remember many details, he confirmed that it was certainly used for commercial purposes in the 1960's. Secondly, after showing photos of this helmet to a senior member of HDS, he also felt confident that the helmet was an unusual example most likely purchased by a commercial dive company and certainly not used by the US Navy.

While some collectors may find this lack of a USN connection disappointing, others, including, myself found this quite interesting. Just think of the early commercial dive jobs where such an extreme helmet was necessary. As a collectible this USN Mark V helium helmet is one, if not the only one, that was ordered new from the manufacturer for use in the commercial industry. It is not one acquired through war surplus, or a standard air Mark V that was retrofitted for helium in a company workshop.

As seen in the photos, it had not been abused and showed no denting and retained all of its original tinning. The number of divers working in the oil field industry who were trained and experienced in the use of this helmet was probably very limited. They would almost certainly have had to been ex US Navy divers (where else could you get trained?) and I wonder what they thought of this helmet with some of the standard Navy features missing from it.

While these helmets unfortunately cannot tell us their history, the details to a degree can, and information on a DESCO WWII model of this helmet in its original configuration can be found in issue 80, page 42. Every helmet is special, but those unique, un-cataloged, examples that allowed divers to perform extreme tasks certainly get my imagination going!

In the 1960s the Electrolung stood out as a groundbreaking design of rebreather diving apparatus. It was the forerunner of many of the modern computerized diving systems that in the future will undoubtedly become increasingly mainstream in both the commercial and amateur diving worlds. While the Electrolung should probably retain its position, this well researched article by Richard Walsby shows that ideas about the electronic/computerized control of rebreather systems was in place much earlier than previously realized.

Before The Electrolung -

Electrically Controlled Rebreathers From The 1950s

By Richard Walsby

During November 2008, I was searching the online patent files for early mentions of the use of helium in rebreathers. One patent caught my eye. It was titled "Electrically Controlled Breathing Apparatus", (1) invented by Dr. Roy P Finney, and described a mixed-gas rebreather that relied on monitoring the change in thermal conductivity of the breathing gas as the proportion of oxygen varied with the breathing cycle. The patent mentioned nitrogen and helium as possible alternative diluent gases The surprising thing was the date. This patent was filed in January 1956, and published in April 1958. It had been published three years before the only other patent I knew, of this nature and period, i.e. the Marion Device made by the Old Dominion Research and Development Corp. of Virginia, although it had been filed later. Dr. Finney's invention could therefore be said to be the earliest published patent for an electrically controlled rebreathing apparatus.

A year earlier, in 2007, Jan Willem Bech (Jan Willem runs the well-known Rebreather Site (2) which seeks to cover the history, development, theory and practice of rebreathers.) had published an article on his website about the Marion Device, noting that it had been submitted to the US Navy Experimental Diving Unit (NEDU) for evaluation and attaching a link to the NEDU evaluation report. Jan-Willem asked if anybody knew anything more about Old Dominion and for any other information about the device, which he believed to be the earliest mention of electr(on)ically controlled breathing apparatus. The Marion Device (I don't know why it was called this) relied on the paramagnetic property of oxygen as opposed to the diamagnetic property of nitrogen to monitor and control any change in oxygen partial pressure. The patent was filed in May 1952, but not published until August 1961(3), nine years later. It is possible that the reason for this delay was that the US Government was interested in acquiring it.

The NEDU evaluation report (4) was generally favorable, noting that the apparatus as submitted was very much an experimental set-up, not yet even a prototype, and concluding that the principle of operation was sound. They suggested that further work was needed to improve its reliability and recommended that the apparatus be modified to correct its deficiencies before being resubmitted for testing. In the event, Old Dominion did not do this but offered another, different apparatus, known as the REX, in 1957. This relied on the change in the velocity of sound in changing gas mixtures to control its operation. NEDU had a lot of trouble testing the REX device because of its generally poor standard of workmanship, but concluded that the principle of its operation appeared feasible. Their work was completed in 1959. (5) I have not found any patent that covers this apparatus.

I wrote to Jan Willem with the news of Dr. Finney's patent. Jan Willem had not heard of it before, and his enthusiastic response prompted me to search further. I found that Dr. Finney had not published anything more on diving gear, but had become a successful urological surgeon with a number of patents for surgical implants and other publications to his name.

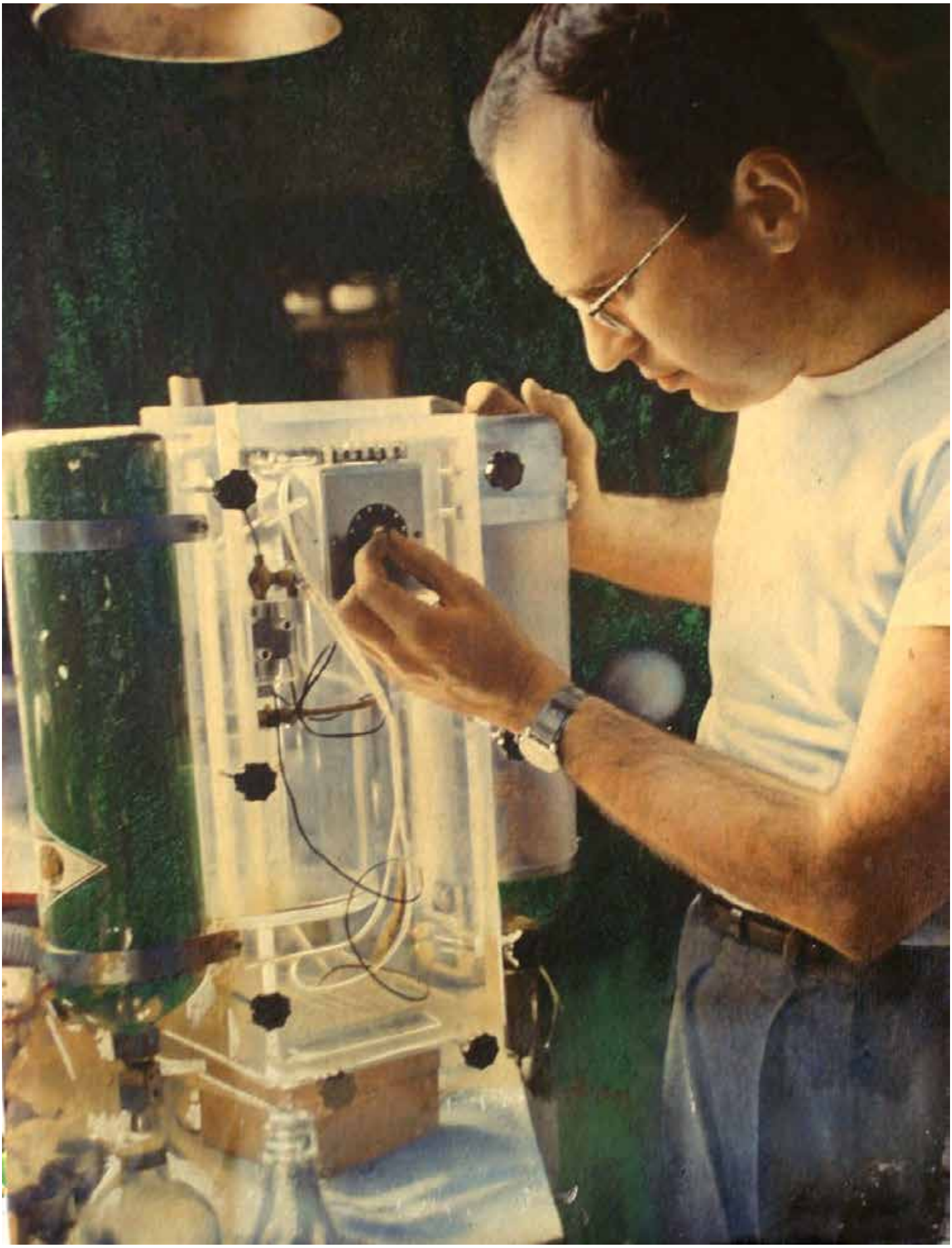
I wrote to Dr. Finney, who now lives in retirement in Florida, asking him for more details on the background of his invention; what was its inspiration; had he been able to construct a working model; was it tested successfully; was he aware of any other, similar work in the same area; and had any attempt been made to develop the apparatus further? Dr. Finney replied very comprehensively and the quotation below is extracted from his correspondence:

"… I am the inventor of the patent you mentioned….. I started diving at age 14 when we made a helmet out of an old galvanised hot water tank - in lakes. While in the Air Corps in WW11 in Dakar a friend and I spent most of our free time spear fishing. I made a self-contained diving rig with air tanks about 1944.

After discharge in 1945 I bought a Desco O2 rebreather and using this gave me the idea of a mixed gas rebreather.

After medical school I went to Johns Hopkins Hospital for five years training as a urological surgeon. The first week there I saw a small 4 x 5 inch oxygen meter which would read % of O2 on a meter scale. I at once realized that if it could do this it could control the O2 % in a mixed gas rebreather. I built the device the following year, in the winter of 1953, in the shop of a friend using the Wheatstone Oxygen detector. [i.e. the circuit used in the O2 meter. RW]. I was in over my head with the amplification needed but managed. I have a picture of me and the device. I was well aware of the dangers of anoxia and knew that one could lose consciousness with no warning whatsoever. For that reason I first tested it in an indoor pool with a group from a local divers club. Underwater I at first had no problems but I later found myself sitting on the side of the pool, coughing and with no knowledge of how I got there. My mates pulled me out.

At this point I should add a word about the O2 meter. In 1950s and before, patients needing O2 were placed in an "Oxygen Tent." This was a flexible clear plastic enclosure, about 1x1x1 m in size placed over the upper half of the patient in bed. O2 was fed into this "tent" and the O2 meter was used to regulate this.



At that time I had less and less time to work on the electronics and I came to understand that in order to be at all safe one would need a triple sensing circuit to monitor O2 levels. A duplex monitor would not work since, if the two were not the same one would not know which was correct.

At that point I realized that I had to proceed with my studies and would not have time to develop this complex, potentially lethal rebreather. So I wrote up the patent with a very old attorney and that was the end of diving work. My childhood friend Charles W. Bailey loaned me $2500 for the patent application and I gave him a share. He had no part in the invention. Several years later, as you must know the Beckman Corp. of Boston (makers of top quality electronic instruments) made the Beckman mixed gas unit and had a 2 week course in Miami to train persons in its use. A man from St. Petersburg FL went on one of his first dives with the Beckman and died! I felt at the time that if Beckman had not made it safe then I saved a lot of time, money and effort by not going on with its development….."

More than 18 years after Dr. Finney's invention, in August and September 1970, *Skin Diver* magazine carried a series of articles on the Electrolung, a rebreathing apparatus invented by Dr. Walter Starck and Dr. John Kanwisher. The Electrolung was a closed-circuit rebreather which used a computer-controlled solenoid valve driven by a polarographic oxygen-sensor to detect the depletion of oxygen in the breathing gas as it was consumed during respiration. The sensor drove the valve through a computerized electronic circuit to make up the oxygen concentration required at any particular depth. This meant that the diver could go to exceptional depths, secure in the knowledge that his apparatus would deliver the correct partial pressure of oxygen to avoid the dangers of oxygen poisoning and reduce the risk of the bends on rising to the surface. In 1968 for example Dr. Starck had used his rebreather down to 400 feet on his fish-collecting scientific expeditions.

Although the Electrolung was initially hailed by the press as the first computer-controlled rebreather, to be fair neither of its inventors claimed as much. The introduction to their patents (6) acknowledged the merits of an earlier device patented by Alan Krasberg, who had invented and patented an electrochemical sensor and rebreathing apparatus to use it in May 1966. (7) The particular emphasis of the Electrolung patent was on the safety aspect, provided by having three independent sensors to monitor the oxygen partial pressure. These sensors were connected with "voting" logic, so that if any one of the sensors failed, the remaining two would be delivering oxygen at the correct partial pressure; obviously an important safety factor.

Alan Krasberg sought the help of the J. H. Emerson company (a manufacturer of respiratory apparatus and well-known for their iron lungs for medical use) and Emerson manufactured Krasberg's apparatus for a while before their lung division was acquired by the Westinghouse Undersea Division.

The article in *Skin Diver* generated a huge amount of interest, and Dr. Starck sold several sets of apparatus before licensing production of the Electrolung to the Beckman Instrument Company who sold many to the armed forces of the US and other countries. Unfortunately, some deaths among sport divers using the apparatus prevented its widespread use, and people came to believe that electronically controlled rebreathers were too complex and dangerous for the general public. The deaths were attributed to insufficient training and unfamiliarity with the strict standards of maintenance required by the apparatus. As a consequence computer controlled mixed-gas rebreathers dropped out of sight of the sports diving public for quite a while until the modern generation of rebreathers appeared for the technical and sport diving community. The Electrolung stayed in limited use amongst specialist divers.

It seems, therefore that the idea of electronic control using some property or other of the breathing gases was very much in the air, so to speak, 18 or so years before the introduction of the Electrolung. The Old Dominion Research and Development Company appear not to have developed the Marion Device or the REX to their fullest potential, although they went on to supply the US Navy with various other bits of diving-related equipment. It is interesting that three of the inventors mentioned here were independent enthusiasts developing their apparatus to help them pursue their underwater passions more effectively.

Acknowledgements

This article would not have been possible without the generosity of Dr. Roy P Finney in taking the time to answer my enquiry, which came to him quite out of the blue, and also supplying the photos which followed it.

I would also like to thank Mr. Jan Willem Bech for technical comments and correspondence.

References

(1) US patent 2830583
(2) http://www.therebreathersite.nl
(3) US patent 2998009
(4) NEDU-3-52 ADA037023 Evaluation of the Constant Partial Pressure Oxygen Underwater Breathing Apparatus
(5) NEDU-1-60 AD0778809 Evaluation of the REX Oxygen Analyzer-Controller for Underwater Breathing Apparatus
(6) US patents 3556098, 3727626 (rebreather), 3000805 (sensor)
(7) US patents 3252458 (rebreather), 3410778 (sensor), also an account in Marine Science Instrumentation, vol 4, 1968, An Operational Closed-Circuit Constant pO2 Breathing Apparatus by Alan Krasberg

Notes

The US patents can be read on the Web at Google Patents, or espacenet or the USPTO website, although you may need special software to read the .tiff images on the latter.

The NEDU reports are available on the website of the Rubicon Research Repository at http://archive.rubicon-foundation.org/

Dr. Starck's account of the development and construction details of the Electrolung has been copied widely on the web and is available at several sites including The Rebreather Site (ref. 2) or **http://news.deeperblue.net/article.php/423/33/0**

A more general account of Dr. Starck's work including his invention of the Electrolung appears in *Sharks & Other Ancestors* by Wade Doak published by Hodder & Stoughton in 1975. There is also his own book on fish collecting (no mention of the Electrolung): *The Blue Reef,* published in 1978 by Alfred Knopf.

I have found a popular account of Alan Krasberg's lung in *Popular Mechanics,* July 1965 p65 *Half A Mile Down With Scuba.* You can read this in "Google Books"; search for Krasberg Scuba.

The following article is a full reprint of the *Skin Diver* magazine article that Richard Walsby references in his article "Before The Electrolung." It was written by the *Skin Diver's* Publisher/ Editor Paul Tzimoulis, and published 45 years ago.

300

feet on computerized scuba

An exclusive SDM test report on the revolutionary closed circuit scuba

BY PAUL J. TZIMOULIS

I hung there, just floating effortlessly two feet from the vertical face of the Great Wall of Andros, enjoying the superb stillness of the deep reef. To my left, 80 feet above, I could see the silhouette of a large black coral tree with the distant sun creating a feather-like effect. A large, curious amberjack eyeballed our movements and executed a series of perfect figure eights between me and my two diving partners. Dr. Walter Starck pointed to his depth gauge and held up three fingers, indicating that we had leveled off at precisely 300 feet. We had penetrated the forbidden world of the deep reef.

There was time—a full five minutes—to observe the fish and be awed by the magnificence of this immense coral cliff. As I soaked up the pleasures of this spectacular sight, I marveled over the ingenious diving machine on my back—a space-age scuba that made such deep dives possible, practical, and safe. At that moment, my life was totally dependent on three small teflon membranes, each of them barely 1/1000th of an inch thick, and a miniaturized electronic computer which silently calculated the proper mixture of the gas I breathed.

Yet knowing all this, I still felt entirely at ease. For the first time in 14 years of scuba diving, I was not concerned about the normal anxieties of being befuddled by nitrogen narcosis or running low on air. I felt comfortable, lucid, and completely in concert with the rhythm of the reef. No noisy exhaust bubbles exploded around my head to send frightened fish scurrying off to the protection of their homes. There was no problem focusing my eyes on the delicate details of the deep water gorgonia, or later recalling exactly what I had observed at this extraordinary depth. I could enjoy everything that went on about me, because I was using an Electrolung—a computer-controlled, closed circuit, mixed gas scuba unit.

The Electrolung, manufactured by Beckman Instruments Company, is the first of a whole new generation of scuba diving devices which will undoubtedly revolutionize deep diving technique. General Electric and BioMarine are also producing closed circuit mixed gas units.

I chose to test dive the Electrolung because it was the first of its kind in the field and it has compiled an impressive record of more than 1,000 open water dives in the past two and a half years. The premise of the basic design is a closed circuit system which continually recirculates the breathing gas after properly filtering and rebalancing the mixture. Closed circuit design offers prolonged breathing gas supply, in which the precious exhaled gas is reclaimed and reused. With the Electrolung, this means six hours of diving on one fill—at any depth, from the surface to 1,200 feet! The limiting factors for duration are actually the effective lifespan of the CO_2 scrubber and batteries rather than the actual gas supply itself.

Another departure from what we as sport divers consider normal or open circuit scuba is the use of gas mixtures in place of compressed air. Until now, closed circuit scuba has been relegated to military or experimental use and is considered almost taboo in sport diving activity. Legends about diving accidents with World War II rebreathers still linger; most scuba instructors treat the subject of rebreathers as though it were a plague, or they ignore it altogether.

The new 1968-1970 generation of closed circuit scuba can utilize a variety of different gas mixtures, depending on the planned diving depth and mode of decompression selected. In the case of the Electrolung, a mixture called "tri-mix" is used for most dives ranging from 50 to 400 feet. Three ingredients are used for a tri-mix setup: pure oxygen, pure helium, and regular compressed air. Pure oxygen is stored in one cylinder, while the helium and compressed air are mixed together in the other so-called "inert gas" cylinder. Tri-mix offers many advantages over a straight heli-ox mix, including lower cost, shorter decompression, and better voice communication. Mixed gas diving enables man to push well beyond the red line depth (132 feet) for compressed air, since the nitrogen narcosis can be eliminated.

What sets the Electrolung and its contemporaries apart from those ancient rebreathers is the fact that this new closed-circuit concept utilizes mixed gas, not pure oxygen, and the diver can visually monitor his gas mixture while underwater. He knows exactly what's going on inside his scuba. The Electrolung is equipped with a unique electrochemical sensor device which can accurately tell the partial pressure of oxygen (signified as pO_2) at any depth or at any time. This information is then fed into a miniature computer which figures how much additional oxygen is required, or it can sound an alarm if something has gone wrong. In other words, the Electrolung automatically monitors, measures, and mixes the breathing gas while you're underwater, regardless of depth or rate of energy expended. Out of this marriage between space age electronics and the closed circuit scuba principle is born a new generation of diving devices, it's the age of computerized scuba.

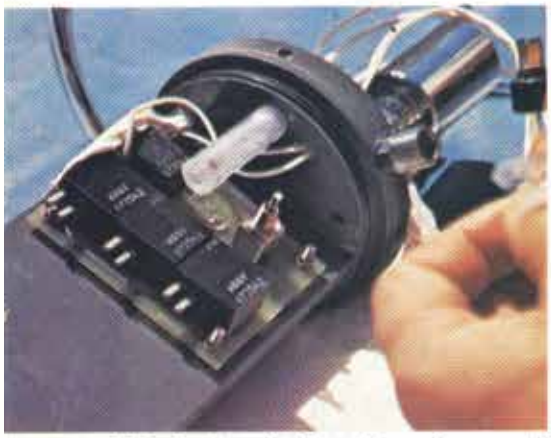
At first glance, the Electrolung appears three times more complicated than it really is. Its intricate network of tubes, wires, and valves tends to bedazzle the mind. Much of this complicated appearance is due to a series of safety back-ups and alternate manual controls which provide a fully integrated fail-safe system. The basic design is a relatively simple assembly.

There are two chrome cylinders which carry the breathing gas supply. These are standard high-pressure tanks capable of holding 11 cubic feet of gas in each cylinder. They are chromed plated because chrome seems to hold up better under the corrosive effects of seawater and because the chrome finish can be seen at maximum distance underwater. The cylinders are also available in a grey Kynar finish, but this is more expensive. Each cylinder is fitted with a standard K-valve. The cylinder on the diver's left is considered the "inert gas" tank and is generally filled with half helium and half compressed air when the tri-mix setup is employed. The resulting mixture in the left tank is 50% helium, 40% nitrogen, and 10% oxygen. A manual shutoff valve and low pressure line run directly from this tank to the breathing bag. This permits the diver to add "inert gas" to the bag as he descends, thus compensating for the increased pressure and reduced breathing gas volume.

The tank on the diver's right is filled with pure oxygen. The first stage of a single hose regulator and a sea vue gauge are connected to the valve of this tank. The diver can check his oxygen supply at any time by just looking at this gauge. The intermediate pressure line from the regulator carries the oxygen to a large chrome solenoid located in the sensor chamber, a cylindrical plexiglas compartment at the top of the unit. There is also a bypass valve and direct tube that leads from the O_2 tank to the breathing system. This is another of the Electrolung's fail-safe designs which is also used as a manual purge device for switching over to pure O_2 during decompression. By switching to pure O_2 for the last 40 feet of ascent, decompression is speeded up.

The large plexiglas cylinder between the two chrome tanks is the CO_2 scrubber canister. It is filled with baralyme, a pinkish (when fresh) granular substance that is a highly efficient carbon dioxide absorbent. The scrubber canister

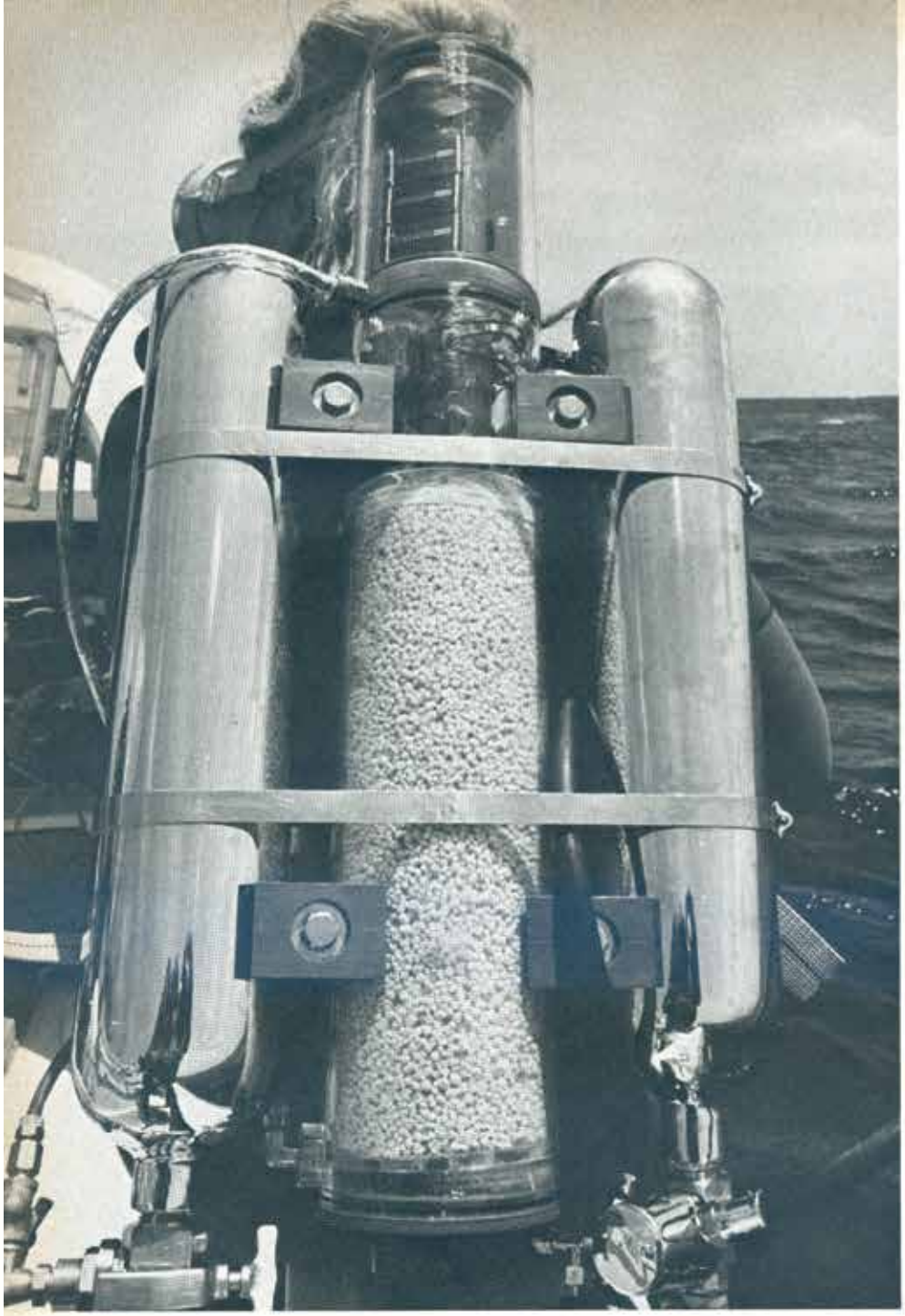
PHOTOS BY AUTHOR



The brain of Electrolung is a small computer the size of a cigarette pack.

Thimble-sized electro-chemical sensors monitor the partial pressure of oxygen.

Walter Starck II, co-inventor, has spent two years refining the design of the lung.



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is constructed of plexiglas so that the diver can easily see if the canister is filled and if the baralyme is fresh. As the baralyme grows old and saturated with CO_2 it turns a purple-blue. The plexiglas cylinder is automatically pressurized to ambient working depth. Should there be a crack or O-ring leak, gas would bubble out instead of water leaking in. The exhaled breathing gas comes down a center tube in the baralyme canister and then filters upward through the surrounding baralyme granules. The canister holds two quarts of baralyme, enough absorbent for six hours of diving in warm water (78°) and three hours in cold water (56°).

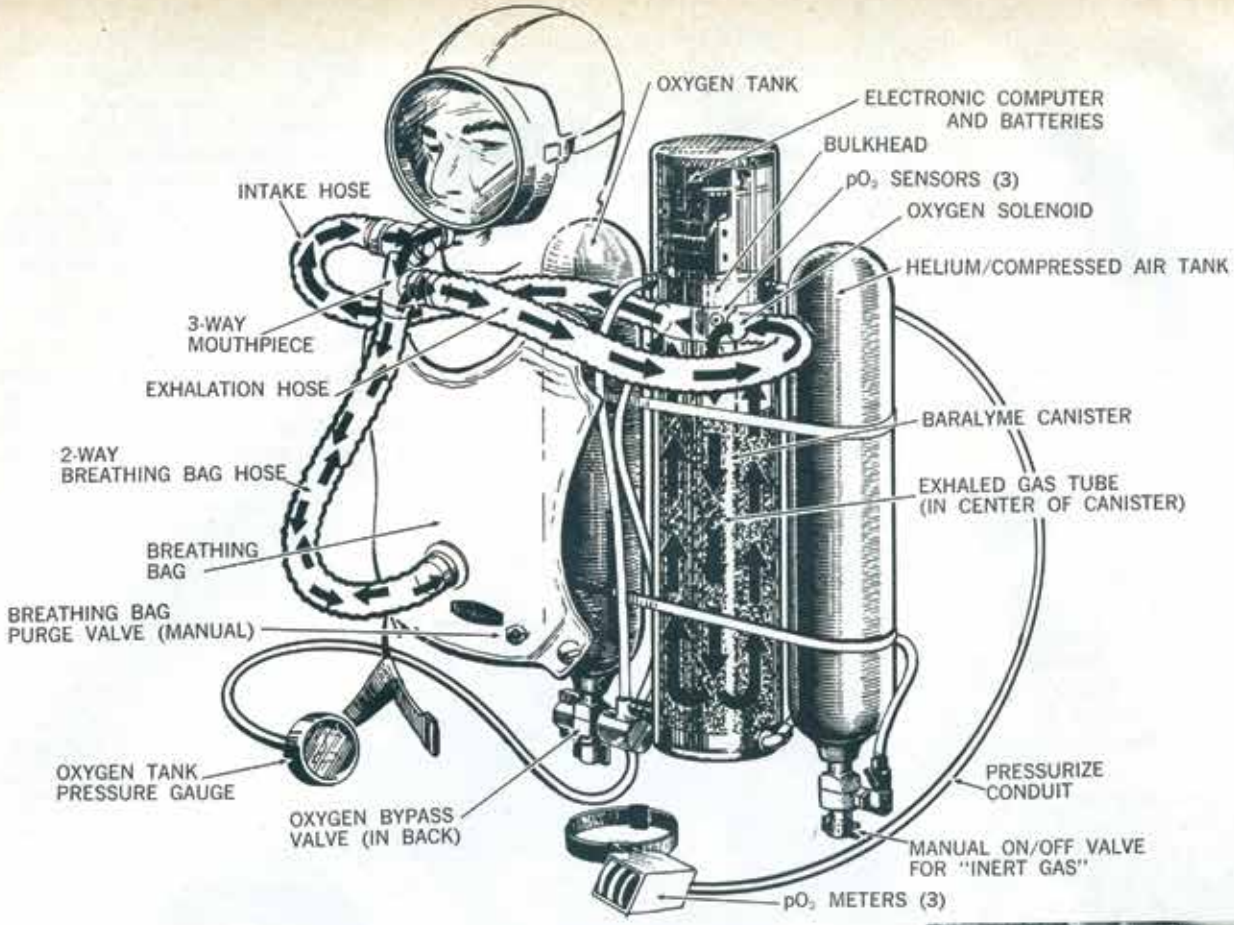
After filtering the CO_2, the freshly cleansed gas is monitored by three separate pO_2 sensors at the upper end of the baralyme canister. These unique sensors are the "nerves" of the Electrolung system. They are polarographic electrodes that operate electro-chemically. Each sensor is about the size of a small thimble constructed from a non-ferrous material. A disc-shaped piece of pure platinum is set in the center of the top end, functioning as the cathode. A deep narrow groove surrounds the platinum disc, and this is filled with electrolyte (potassium hydroxide). The outside edge of the groove is a thin concentric wall of pure silver, and this is the anode. The entire electrode is then covered with a teflon membrane which is less than paper-thin—only 1/1000 of an inch thick. An electrical potential of a little more than ½-volt is then supplied to the electrode. The amount of oxygen which diffuses through the teflon membrane then determines exactly what the partial pressure of the oxygen is at any given depth. It is this partial pressure (pO_2) which determines the correct balance in mixed-gas diving.

The Electrolung could operate well on one pO_2 sensor, but the combination of three electrodes is part of the unit's fail-safe design. The manufacturer describes it as "triple redundancy" design. According to the inventor, Dr. Starck, the estimated possibility of one sensor having an electro-chemical failure during a dive is one in a thousand. However, the chances of two sensors failing simultaneously is one in a million, and the odds against all three going bad are one in a billion.

The readings from all three sensors are fed into the Electrolung's brain—a miniature analogue computer. The computer takes an average of the three separate readings, and if one of the sensors is reading abnormally high or low, the computer automatically "freezes" or "clips" the input from the malfunctioning sensor. It then utilizes the input from the remaining two sensors and takes an average of that data.

While Electrolung's brain is silently analyzing the input data from the sensor, the diver is also able to observe the behavior of the sensors. Three separate readout meters are strapped to the diver's left forearm, indicating the readings of each meter. The meter scale goes from 0 to 100. A reading of 20 means the partial pressure of the oxygen in the system is equal to air at normal atmospheric pressure (sea level). A reading of 100 means the pO_2 is equal to one atmosphere of water (33 feet). Under normal Electrolung operation, the meter needles are in the 50 to 55 range, which means the diver is breathing a pO_2 inert gas mixture equal to pure oxygen at a depth of 16 feet. This is considered the optimum gas mixture for the Electrolung, since the diver enjoys a wide safety margin on both the high and low sides of prescribed pO_2 setting.

The Electrolung's brain is probably the most fascinating aspect of the entire



An Electrolung diver adjusts the pO_2 readout on an early prototype model of the computer, now condensed into miniaturized solid-state modular components. At far right, Jo Starck goes through a pre-dive checkout and assembly of the unit. Fresh electrolyte is added to the oxygen sensors to insure accurate meter readout. The components of the Electrolung (opposite page) consist of the baralyme CO_2 absorbent, flanked by two chromed tanks of compressed gas, with electronic computer behind the head.

system. The whole computer is hardly bigger than a pack of cigarettes, but crammed into this space is a highly sophisticated electronic machine that can monitor, average, signal, and operate the system. Most of the computer's components are miniature, solid state transistor circuits—one of those beneficial spin-offs from the U.S. space program. Five years ago, this kind of electronic circuitry didn't exist. The computer is powered by two nine-volt manganese alkaline batteries, and parallel to it is an extra set which is wired in as standby power (still another fail-safe feature). The diver can switch over to the spare batteries at any time during the dive. The computer and batteries are housed in a separate plexiglas compartment on top of the baralyme canister. It is also watertight and pressurized to ambient operating depth.

The computer performs three individual functions during an Electrolung dive. First, it reads, analyzes and averages the input of the pO_2 sensors, and it automatically compensates for temperature changes that might ordinarily effect the readings. Second, it activates an audio warning signal if the pO_2 in the system is higher or lower than normal. An audio-beeper alerts the diver the minute the pO_2 meters drop below 35 or rise above 70. The unit is still well within the safe operating range when the alarm goes off, but it does inform the diver that the gas mixture has changed in the Electrolung.

Once the alarm has sounded, and the gauges indicate low pO_2, the computer automatically compensates for the decrease in oxygen by activating the oxygen solenoid valve. A shot of pure oxygen is injected into the breathing system right at the upper end of the baralyme compartment. This brings the pO_2 back up to the prescribed balance in a matter of a few seconds—the time it takes to mix the fresh oxygen throughout the breathing system.

During a normal Electrolung dive, the audio-beeper goes off every two minutes, indicating a drop in pO_2. The alarm is immediately followed by the

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hissing sound of the solenoid as it injects oxygen. The beeper momentarily sounds off again because of the now oxygen-rich mixture in the sensor compartment, but this alarm ceases as the O_2 is circulated throughout the system. The beeper is then silent for another two to four minutes before the cycle is repeated. The frequency of O_2 injections is relative to the operating depth . . . less often as you go deeper.

Because the Electrolung is a closed circuit unit, it is equipped with a breathing bag. The bag provides a place for the exhaled gas to go before the diver makes his next inhalation. It's a sort of seesaw balance: When the diver's lungs are empty (exhalation), the bag is full; when the diver's lungs are full (inhalation), the bag is empty. The Electrolung bag is different from other breathing bags in that it is made of a translucent plastic fabric. The semi-clear plastic permits sunlight to kill or prevent fungus growth from accumulating on the bag interior walls. The bag is attached to the diver's chest harness because this is the point closest to his lung and it provides the easiest breathing in a swimming position. A drain plug in the lower left front of the bag permits the purge of any water accumulation. It can be purged underwater in the same manner as clearing a face mask.

The Electrolung mouthpiece is fitted with a three-way valve. Fresh gas is inhaled from the diver's right-hand breathing tube. Meanwhile the exhaled gas in the bag passes up the middle tube and out the left-hand exhaust tube. Upon exhalation, both the left and right-hand tubes are shut and the exhausted gas passes down the center tube and into the breathing bag. It is only a little more complicated than two-hose regulators.

In order to fully understand the circuitry and function of the Electrolung, a novice needs only to read the operating manual twice and work with the unit for approximately one day. Learning to actually dive with an Electrolung is not difficult, but a formal course of instruction is definitely required. Closed circuit, mixed gas scuba is an entirely different mode of diving and there's a good deal of reorientation in diving physics and decompression technique required in order to make the transition. In the field of sport diving, closed circuit scuba would probably be limited to certified advance divers, scuba instructors, and semi-professional divers. The Electrolung is not a toy, nor can its usage and maintenance be treated as casually as regular open circuit scuba.

The process of learning to dive the Electrolung and mastering the basic predive and maintenance procedures take approximately the same amount of time as learning to solo in a private aircraft—from nine to twelve hours, depending upon the student. Three or four dives, one in the pool and the rest in open water, are sufficient for gaining the necessary coordination and self-confidence to dive the unit.

However, there is another six to twelve hours of classroom lecture and study necessary for learning the theory of mixed gas diving. All of the physics and theory related to open circuit scuba decompression and gas consumption no

U/W photographer Bob Hollis checks out the Electrolung for cold water diving. At lower temperatures, the effective absorption time for baralyme is reduced.

longer apply. Even though you may be an experienced and knowledgeable compressed air diver, you must begin all over again, relearning the principles of partial pressures, mixed gas diving tables, CO_2 absorption rates as related to temperatures, etc. It would be reasonable to assume that an experienced sport diver would require 20 to 24 hours of instruction to become qualified as an Electrolung diver.

To give you some insight into the skills required, let me relate my own learning experiences leading up to my 300-foot check-out dive. I flew to Andros Island in the Bahamas to spend a week aboard the research vessel TORITO, where I was to study and dive with the unit. My tutors were Dr. Walter Starck, II, co-inventor of the Electrolung, and his very capable diving assistant and wife, Jo Starck.

I spent the first day going over the basic features of the Electrolung with Dr. Starck and observing his diving team make a 280-foot dive on the Wall. I watched each diver make a pre-dive check of their unit, which included a check of the battery voltage, application of fresh electrolyte to the pO_2 sensors, and recalibration of the pO_2 meters. This procedure generally took 15 to 20 minutes. We were to make our dive from a 22-foot open boat and I was happy to see that no specially delicate care was needed for topside handling. The Electrolungs were placed in the bottom of the boat, right beside the standard compressed air tanks, with no apparent concern about the sun or salt spray. Since the Electrolung only weighs 35 pounds, it can be easily strapped on by the diver alone, but assistance from a buddy is much more convenient. Dr. Starck pointed out the need for additional four to six pounds of lead weight for Electrolung diving to compensate for the extra buoyancy of the breathing bag and closed circuit system. While I was observing the Electrolung divers underwater, I found that they dived in very much the same way as compressed air divers except that the fish were not frightened by their approach. The absence of exhaust bubbles seemed to be a great advantage.

I made my first Electrolung dive the very next day, in approximately 60 feet of water. We chose the site of the LCR wreck off Small Hope Bay Lodge for this familiarization session, since I had previously made many dives in this area. Starck explained that it was easier to start with an Electrolung in open water rather than in a shallow pool with little pressure changes and in at least 30-60 feet of water because there was less pressure differential at this depth zone and therefore less need to compensate the breathing bag volume for slight changes in depth. The breathing bag is the thing that is most likely to confound a sport diver on his first Electrolung dive. The trick is to compensate for changes in depth by decreasing or increasing the gas in the bag as you go up or down.

On my first descent I found that if I did not valve the inert gas in fast enough, the bag would flatten against my chest and I could not make the next inhalation. On the other hand, if I valved in too much gas, the bag would overinflate like a big pillow and I would gain too much positive buoyancy. After a few practice runs up and down the anchor line, I found that one can easily coordinate the correct flow of inert gas with the rate of descent. Once mastered, it is no problem. Also, I quickly discovered the left hand must remain free of cameras or other accessories in order to manipulate the inert gas valve—another subtle alteration in diving method.

With the Electrolung, you can breathe as fast or as slow as you want since the frequency of inhalation does not effect the gas supply or duration of the dive. However, Dr. Starck suggests breathing

(Continued on Page 70)

Electrolung divers are finding that clear-headedness and the lack of bubbles are just two advantages in deep sea research and photography. In addition, they are able to remain longer at depths without narcotic effects and subsequent lengthy decompression. Dr. Glen Egstrom of UCLA (upper right) checks out the unit in all possible underwater positions while author Tzimoulis (lower right) prepares to make a 300-foot-deep test dive.

about twice the rate of compressed air scuba in order to keep the CO_2 level as low as possible. This increased breathing rate speeds up the circulation of the gas through the baralyme scrubber. However, inhalations should be shallower than normal.

I was amazed at the underwater handling qualities of the Electrolung—I hardly knew it was there! It rides flat against the back with very little drag. It is thinner and better balanced than single tank scuba. The electronic computer compartment is quite buoyant and causes the upper portion of the unit to float high and away from the diver's head. Not once did I find the Electrolung banging against the back of my head.

It takes about 10 to 15 minutes to become accustomed to the rhythm of the Electrolung's O_2 mixing cycle. The first few times the beeper alarm went off, I found myself over-reacting by scanning the pO_2 meters for a problem. The reassuring hiss of the solenoid promptly relieved my concern, and after a little while the beeper became a normal part of the routine. You can tell the Electrolung is functioning as it should by just listening to it.

I experienced a slight amount of water leakage during the first few minutes—again due to my unfamiliarity with the breathing bag. When not handled properly, the bag's buoyancy can cause a tug at the mouthpiece just enough to cause a trickle. Fortunately, the water merely collects in the bottom of the breathing bag and can be purged.

My second dive with the Electrolung was far more enjoyable; in fact, it was an absolute ball! I had made the transition to closed-circuit scuba and now felt completely at ease with the unit. I had the breathing bag coordination down pat and made my 180-foot descent without hesitation. It was just a matter of valving in the inert gas at a slow, steady rate as I swam down the anchor line. I was no longer preoccupied with the Electrolung's basic functions and I really began to enjoy its advantages.

Diving is much quieter with closed-circuit scuba, and one becomes much more aware of the little sounds made by fish, shrimp, and other creatures on the reef. Two of our divers were wearing regular scuba, and you could hear them approaching from 200 feet away. They sounded like a couple of Sherman tanks motoring across the sea floor—no wonder the fish madly dashed for cover as these noisy intruders arrived!

My final check-out dive to 300 feet was perhaps the greatest thrill of my life. Penetrating the deep reef zone is like entering a whole new world of the sea—a strange and fascinating ecosystem of brightly-colored gorgonia, unidentified corals and even unnamed fish. There was no need to expend unnecessary effort in swimming since we could maintain excellent control and direction by altering the buoyancy of the breathing bag. An extra shot of inert gas would slow or stop descent while an exhaust would resume our downward travel.

The absence of nitrogen oppression was remarkable, and diving at 300 feet felt as simple as 30 feet . . . there was no dulling of the senses, no fumbling of the hands, no blurred, warped vision. Everything seemed crystal sharp. Dr. Starck's Luminaut headlamp lit up a 100-foot square of the coral wall, revealing a Picasso patchwork of vivid reds, yellows, and orange marine life.

We began our ascent very slowly, taking a full five minutes to get from 300 to 200 feet. There was no need to rush and no need to exert ourselves, for the Electrolung contained more than enough gas supply for the lengthy decompression. We kept our breathing bags slightly fuller now than during descent, adding just enough buoyancy for easy ascent. We continued our slow and easy rise up the anchor line until we reached 35 feet, where it was time to switch over to pure oxygen.

The procedure was simple; first the inert gas supply is shut off. Then the system is purged by exhausting all of the gas in the breathing bag and replacing it with pure oxygen via the oxygen by-pass valve. The purging procedure is repeated several times until all three pO_2 meters read 100, indicating a pure oxygen mix. The dive and decompression were completed without a hitch.

There is no doubt that the Electrolung has a bright future in diving, but skeptics may ask, "Is it practical—is it perfected?" (Especially at $2975.00.)

Unlike cyrogenic scuba or other experimental diving devices, the Electrolung has already graduated from the prototype stage. Beckman Instruments' assembly plant in Fullerton, California, is currently building the units as fast as possible. Over 30 units are presently in the field, being used for practical work in the 150 to 250-foot range. The Makai Range successfully used Electrolung units along with standard gear during their Aegir underwater habitat experiment last June. A growing number of professional underwater photographers are beginning to utilize closed-circuit scuba because of the absence of exhaust bubbles and narcosis.

At this point in history, the Electrolung stands as the newest, most exciting milestone in the further development of scuba equipment. It provides the key for extending the boundaries of safe undersea exploration, and opens the door to a whole new plateau of discovery. ➤

By Kevin Hardy and Ian Koblick

Following the theme of undersea habitats in the Journal of Diving History, starting with the 50th Anniversaries of SEALAB I *then* SEALAB II, *this series of reports continues with an adaptation of Dr. Joseph MacInnis's informative March 1966* Scientific American *article "Living under the Sea."*

Living under the Sea

By Dr. Joseph B. MacInnis

Adapted from
SCIENTIFIC AMERICAN,
March 1966

It is one thing to glimpse a new world and quite another to establish permanent outposts in it, to explore it and to work and live in it. Now, however, men are beginning to try to live underwater- to remain on the bottom exposed to the ocean's pressure for long periods and to move about and work there as free divers. The submerged domain potentially available to man for firsthand investigation and eventual exploitation can be regarded as a new continent with an area of about 11,500,000 square miles the size of Africa. It comprises the gently sloping shoulders of the continents, the continental shelves that rim the ocean basins. The shelves range up to several hundred miles in width and are generally covered by 600 feet of water or less. That they are submerged at all is an accident of this epoch's sea level: the ocean basins are filled to overflowing and the sea has spilled over, making ocean floor of what is really a seaward extension of the coastal topography. Geologically the shelf belongs more to the continents than to the oceans. Its basement rock is continental granite rather than oceanic basalt and is covered largely with continental sediments rather than abyssal ooze.

Not surprisingly, mineral deposits similar to those under dry land lie under the shelf. Oil and natural gas are the foremost examples. But there are other reasons direct undersea investigations. One is the increasing interest in all aspects of oceanography, including geological, chemical, biological and meteorological. Likewise salvage and submarine rescue will benefit from manned bottom outposts.

The reasons for going underwater are balanced by an impressive list of potential hazards. Most of them stem from the effects of pressure, which increases at the rate of one atmosphere (14.7 pounds per square

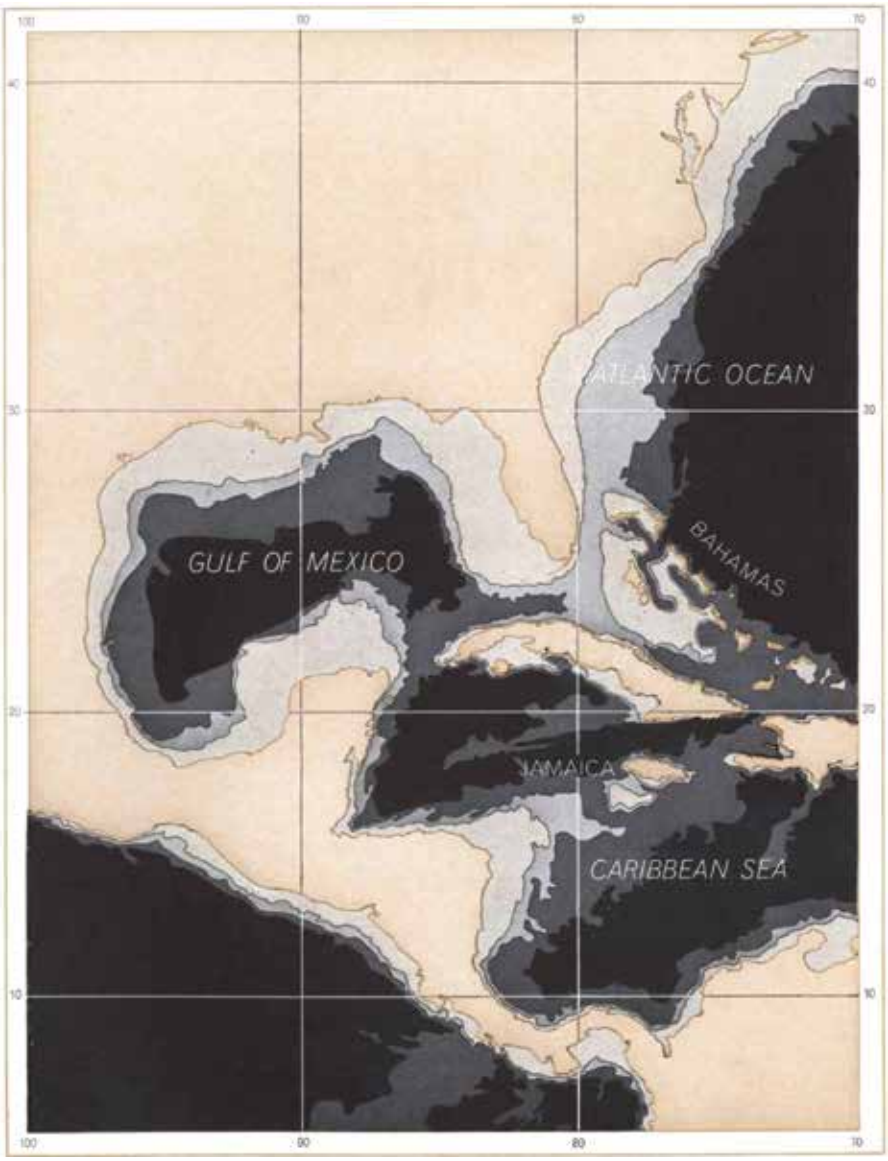


FIGURE 1: CONTINENTAL SHELF (lightest areas) off part of North America is shown. It is less a part of the ocean basin than it is an extension of the continental land mass. As in most parts of the world, the shelf slopes gently to about 600 feet below sea level; then the continental slope plunges toward the floor of the ocean basin. On this map, based on charts of the International Hydrographic Bureau, the contour intervals are in meters rather than feet. The lightest tone shows the bottom from sea level down to 200 meters (655 feet); successively darker blacks indicate bottom from 200 to 1,000, 1,000 to 3,000 and deeper than 3,000 meters.

inch, or 760 millimeters of mercury) with every 33 feet (10 m) of depth in seawater.

The best-known hazard and one of the most dangerous is decompression sickness, the "bends." Under pressure the inert gas in a breathing mixture (nitrogen or helium) diffuses into the blood and other tissues. If the pressure is relieved too quickly, bubbles form in the tissues much as they do in a bottle of carbonated water when it is opened. Sudden decompression from a long, deep dive can be fatal; even a slight miscalculation of decompression requirements can cause serious injury to the joints or the central nervous system. A diver must therefore be decompressed slowly, according to a careful schedule, so that the inert gas can be washed out of the tissues by the blood and then exhaled by the lungs. Whereas the demands of decompression become more stringent with *depth*, with *time* they increase only up to a point.

After about 24 hours at a given depth the tissues become essentially saturated with inert gas at a pressure equivalent to the depth; they do not take up significantly more gas no matter how long the diver stays at that level. Therefore if a diver must descend to a certain depth to accomplish a time-consuming underwater task, it is far more efficient for him to stay there than to return to the surface repeatedly, spending hours in decompression each time. Although this "saturation diving" is efficient, it imposes an extra technical burden, because the schedules for the ultimate decompression must be calculated and controlled with particular care.

Pressure also has significant effects on a diver's breathing requirements. For one thing, hyperoxia (too much oxygen) becomes almost as dangerous as hypoxia (too little). Acute hyperoxia can affect the central nervous system, causing localized muscular twitching and convulsions; chronic hyperoxia impairs the process of gas exchange in the alveoli, or air sacs, of the lung. Optimum oxygen levels are still under investigation; they vary with the duration, depth and phase of the dive and the muscular effort required of the diver. It is clear, however, that the "partial pressure" of oxygen should be kept at a constant 150 and 400 millimeters of mercury during the at-depth phase of a long saturation dive. The partial pressure of oxygen in the air we breathe at sea level is 160 millimeters of mercury (21 percent of 760). If oxygen is kept at 21 percent of the mixture, however, its partial pressure increases with depth, rising to 1,127 millimeters 200 feet down, for example. As a result, the proportion of oxygen in the air or other breathing mixture must be cut back sharply from 21 percent. The band of permissible percentages narrows rapidly with depth calling for increasing accuracy in the systems that analyze and control the gas mixture.

Nitrogen, which is physiologically inert at sea level, has an anesthetic effect under pressure. At depths greater than 100 feet it begins to produce "nitrogen narcosis," that can impairment a diver's judgment and motor ability. Helium has been found to be much less narcotic and currently replaces nitrogen in almost all deep-sea dives. Being less dense, it also offers less breathing resistance under pressure; important to a working diver. Helium has two disadvantages, however. Because its thermal conductivity is almost six times as great as nitrogen's, it accelerates the loss of body heat and makes a diver uncomfortably cold even at temperatures of 70 or 80 degrees. Helium also distorts the resonance of a diver's voice, making his speech almost unintelligible and thus giving rise to a serious communication problem.

In any confined environment the buildup of exhaled CO2 (carbon dioxide) must be monitored carefully.

In diving experiments at Ocean Systems, Inc., we kept the partial pressure of CO2 below 7mm of mercury (compared with the sea-level pressure in fresh air of 0.3 millimeter), while at the U.S. Naval Medical Research Laboratory in New London, Conn., Karl E. Schaefer has found that at sea level slightly higher levels are tolerable for several weeks. In any case, CO2 accumulates rapidly in a small space and soon reaches a toxic level, causing dizziness, headache and an increase in the rate of breathing. It must therefore be continuously "scrubbed" out of the diver's atmosphere, usually by being passed through a chemical with which it will react. Other gases, such as CO (carbon monoxide) and certain volatile hydrocarbons, can also reach toxic levels quickly if they are allowed to concentrate in the diver's breathing mixture.

There are sometimes other obstacles to casual access to the ocean floor: a demoralizing lack of visibility, strong currents, and uncertain bottom profiles. There are also dangerous marine animals, ranging in size from a unicellular infective fungus to the widely feared great white shark. Finally, the water of the continental shelf is cold. Temperatures average between 40 and 60 degrees, and without protective clothing a diver soon becomes totally ineffective.

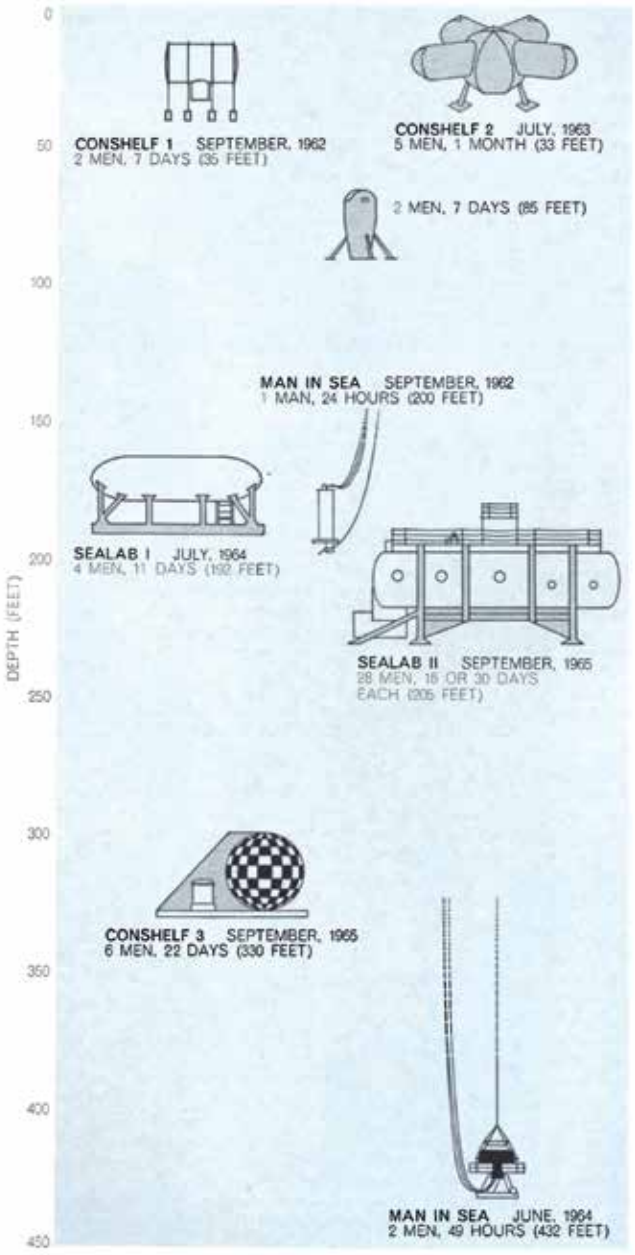


Figure 2: SATURATION DIVING, in which the divers stay down for prolonged periods, is made possible by underwater shelters. The chart gives data for seven such dives. "Man in Sea" is the Link project, "Conshelf" is Jacques-Yves Cousteau's, and "SEALAB" is the U.S. Navy's.

Faced with these difficulties commercial divers and undersea investigators found it impossible to spend time and do useful work on the continental shelf. Those who went down in pressurized suits and thick-hulled submersible vehicles were held prisoner by their protective armor. Free divers, on the other hand, could not go very deep or stay very long.

Before open-sea experiments were possible some preliminary research was necessary.

How deep could a man go as a free diver? How long could he stay down? What would be the acute and the long-term medical effects of the pressure itself and of the synthetic atmosphere? What would be the response to the cold, the confinement and the psychological hazards of deep submergence? Some early and significant answers were provided by Captain George F. Bond, a U.S. Navy physician who in 1957 conceived and carried out a series of simulated dives in a compression chamber on land at the Naval Medical Research Laboratory. Bond's group first exposed small animals, including some primates, to a pressure equivalent to a depth of 200 feet. Volunteer Navy divers then lived in the chamber under precisely controlled conditions of pressure, temperature and humidity. These experiments showed, among other things, that men could breathe helium instead of nitrogen for long periods without ill effects and encouraged Link and others to move ahead.

In the U.S., Link and Bond were designing pressure experiments and engineering diving systems that would enable free divers to reach greater depths safely. From late 1963 until March 1964, a series of simulated saturation dives-the first such dives deeper than 200 feet-were carried out under the technical direction of Captain R. D. Workman at the Navy's Experimental Diving Unit in Washington DC. The tests showed that divers suffered no harmful effects when exposed to depths of 300 and 400 feet for 24 hours and that they could be decompressed successfully on a linear decompression schedule.

Figure 3: An UNDERWATER DWELLING called the SPID (for "submerged, portable, inflatable dwelling") was designed by Edwin A. Link as a base of operations for long dives to the continental shelf, here undergoing a pressure test at 70 feet. In the summer of 1964 two divers occupied the SPID for two days at 432 feet below the surface.

In addition to Link's Man-in-Sea "Submerged Portable Inflatable Swelling" (SPID), (the subject of an upcoming *JoDH* article, 2016, Vol 24, Issue 86) there have been a number of other recent saturation diving experiments, two of them conducted by Bond's Navy group. The first, "SEALAB I," took place off Bermuda later in July, 1964 (the subject of the *JoDH* Volume 22, Number 79). Four men lived for 10 days in a large cylindrical chamber 192 feet below the surface. Last summer the Navy conducted "SEALAB II," a massive 45-day effort involving three teams of 10 men, each of which spent 15 days underwater (the subject of the *JoDH* Volume 23, Number 84). The base of operations was a cabin 57 by 12 feet in size submerged in 205 feet of water near the Scripps Institution of Oceanography at La Jolla, Calif. The SEALAB "aquanauts" salvaged an airplane hulk, did biological and oceanographic research and conducted psychological and physiological tests. Electrically heated suits made it possible for them to work comfortably in the 55-degree water.

In the Mediterranean off Cap Ferrat, Cousteau's group last fall made another significant advance in underwater living. Six men lived for almost 22 days in Conshelf III, a spherical dwelling 330 feet below the surface, linked to the surface by only an electrical and communications cable. Cousteau's "oceanauts" concentrated on difficult underwater work, including the successful emplacement and operation at 370 feet of a five-ton oil-well head in which oil under pressure was simulated by compressed air.

As men go deeper and stay longer the hazards increase and safety margins narrow, new questions arise. At what depth will even helium become too narcotic or too dense to breathe? Can hydrogen serve as an acceptable substitute? At what depth will pressure effects

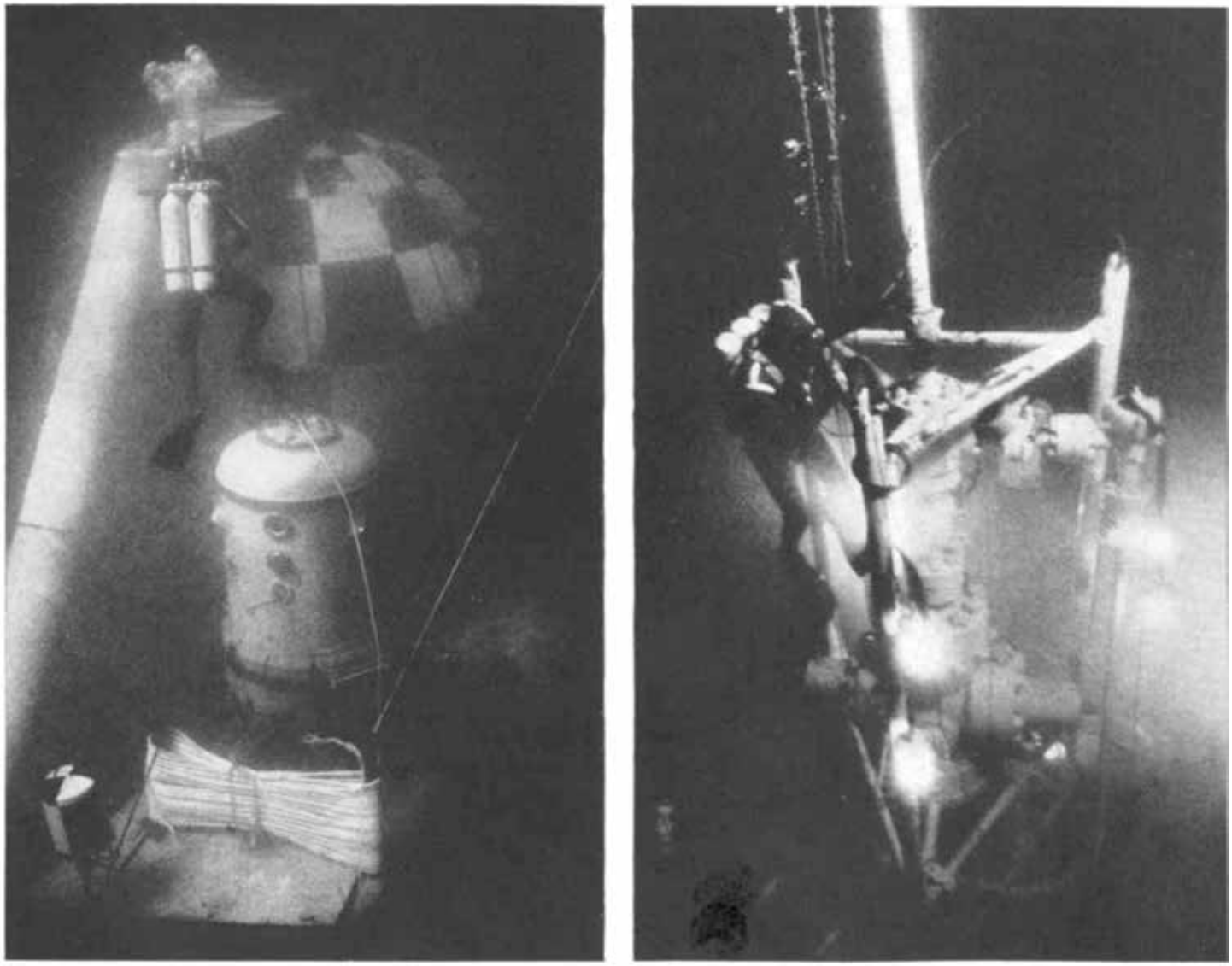


Figure 4: "CONSHELF III" station at 330 feet was occupied by six divers of Cousteau's group last fall. The spherical dwelling in which they lived is shown at the left in a photograph made from Cousteau's diving saucer. The elongated shape (far left) is a fin for stability under tow; the turret· shaped structure is a compression chamber for emergency escape to the surface. The major task accomplished by the divers was the installation and repair of an oil·well head (right). They were able to manipulate repair tools to handle emergency breakdown situations met in actual production. In the photograph a diver is guiding a tool pipe into the wellhead.

cause unacceptable changes in tissue structure? What will be the decompression obligation after saturation at 1,000 feet or more? And what are the residual effects of repeated exposure to great depths?

Again, the answers are beginning to come from dry-land experimentation. Last fall two Ocean Systems divers simulated a dive to 650 feet in our test chamber. They stayed at that pressure for 48 hours, becoming completely saturated with 20 atmospheres of helium. Our results indicated that helium is safe -at least at the depth and for the length of time involved in the test- and suggested that it may be possible to continue with helium as the inert gas even beyond 1,000 feet. We found that breathing an oxygen-neon mixture for 30 minutes at 650 feet caused no measurable narcotic or other detrimental effects and that it markedly improved voice quality. Heart and lung function, exercise tolerance, psychomotor performance and blood and urine characteristics were all within normal limits. I think the most significant result of this longest deep-pressure experiment to date was our impression that divers will be able to perform physical and mental work almost as effectively at 650 feet as at the surface.

There do not, then, seem to be any physiological or psychological barriers that will prevent the occupation of any part of the continental shelf. Nonetheless, it is important to recognize that so far all efforts to live under the sea have been investigations or demonstrations of man's ability to do so. In the last analysis men will live underwater only when specific tasks, with economic or other motivations, present themselves. At this point, however, the gates of the deep shelf have been opened.

Author: Dr. Joesph MacInnis currently studies leadership in lethal environments. He worked on James Cameron's last three deep-sea science expeditions, including the DEEPSEA CHALLENGE Expedition. His latest book, Deep Leadership: Essential Insights From High-Risk Environments, *was published by Random House.*

The full text of MacInnis' original *Scientific American* article is available for a small fee at: <http://www.scientificamerican.com/article/living-under-the-sea/>

HDS GWS 2015

with Special Guest Chuck Nicklin

By Dan Orr, Chairman HDS

The Annual Historical Diving Society (HDS) fundraising trip to Guadalupe Island, Mexico to dive (in cages, of course) with the Great White Sharks took place October 9-14, 2015. Guadalupe Island, a Mexican Biosphere Reserve, is located nearly 200 nautical miles west of Ensenada, Mexico out into the Pacific Ocean and has the largest resident population of Great White Sharks in the world. The dive operators visiting the island have identified and named over 170 different Great Whites around the island. These annual trips are organized by HDS member Ed Stetson who generously donates the proceeds to the Historical Diving Society. Each HDS trip is hosted by a well-known personality in the diving world and past hosts have included Ernie Brooks, Stan Waterman, Rodney Fox, David Doubilet, Bob Hollis, Bev Morgan, Bob Meistrell and Zale Parry. The special guest host for this year's trip was famous underwater filmmaker, Chuck Nicklin accompanied by his lovely wife Roz. Chuck was finishing his new book, *Camera Man*, which was available for sale at the annual DEMA Show in Orlando, Florida. This year's trip to Guadalupe Island was my 9th adventure to this magnificent and mysterious island.

After meeting at the Ramada Inn Airport in San Diego, the guests boarded a comfortable bus for the nearly two-hour trip to Ensenada, Mexico to meet the live aboard, *Belle Amie*, the newest addition to the Nautilus Fleet. The bus arrived in Ensenada at about 10:00 PM and was greeted by a fantastic crew with margaritas while they took the luggage directly to the staterooms.

After checking into their assigned staterooms, guests familiarized themselves with their home for the next six days and enjoyed some camaraderie in the ship's lounge. Once underway, the gentle rocking of the boat made sleeping easy. While the *Belle Amie* made its way west for the 20-hour trip to Guadalupe, most of the guests spent the next day working on their photo equipment and inventoried their diving gear (we only needed an exposure suit and mask with weights and surface-supplied breathing equipment supplied by the boat). The following morning included crew introductions and shipboard safety protocols including the obligatory life jacket drill.

During the transit, guests participated in Shark Cage Diving 101 where the crew described the *Belle Amie's* submersible and fixed shark cages. Guests were told about an exciting addition to every evening's itinerary called 'Shark Bingo' where guests take pictures of Great Whites during the day of diving and show them in the evening while everyone tries to identify the sharks we've seen using the onboard identification book. In that way, guests can record the names of the sharks they've seen and possibly identify a new shark that has not previously been identified or named. If a new shark is identified, the first person to photograph it may get the right to name it.

As the sun approached the horizon, the *Belle Amie* reached Guadalupe Island, dropping anchor in a sheltered cove around 10:00 PM. Once anchored, the crew went about putting the five tubular stainless steel shark cages in the water. One cage was secured at the surface, a second was secured approximately 15' below the surface and the other three were submersible, attached to the *Belle Amie* by steel cables and lowered to a depth of approximately 30'. The three submersible cages accommodate three divers at a time while the two fixed depth cages can hold four divers each. All the divers breathe through regulators with hoses coming from the surface. Just in case there would be a problem with that air supply, each cage has filled scuba cylinders with multiple regulators. The two fixed cages were open on a first-come basis from 6:30 AM to 5:00 PM each day while the submersible cages had pre-assigned time 45-minute time slots giving each diver at least three submersible trips a day.

As the sun rose on Guadalupe Island on the first day of diving, there was a flurry of activity as divers queued up for

the fixed cages and teams of divers readied themselves and their camera gear for the trips in the submersible cages. Things got off to a fantastic start the first day with two Great Whites sighted by divers in the fixed cages before the first submersible cage runs began. The three submersible cages were on a staggered schedule descending in rotation about 10 minutes apart. This meant that there were cages ascending and descending almost constantly. Cage movement seemed to have a positive effect on the Great Whites giving the divers more opportunities to see these apex predators in motion.

From the time the very first diver entered a cage until the end of the trip, there was constant Great White activity.

Every diver, on every dive saw Great Whites most often in pairs with many of the dives having three, four or even five sharks within sight of the cages. This was more shark activity than any of us could recall seeing on any previous trips to Guadalupe island. The sharks were all very curious and came close to the cages occasionally bumping them with their noses or backs and then every once in awhile one would actually mouth the cage bars.

Since there are very strict rules regarding baiting and chumming in the water around Guadalupe Island, the crew did whatever they could to keep the sharks around the cages. The photo opportunities from the submersible cages were some of the very best any of the divers had ever seen including some 'up close and personal' photos of Great Whites exhibiting different kinds of behavior.

Days 2 and 3 continued to have near perfect conditions with water temperatures warmer than in past years (73° compared with the usual 68°) and visibility often exceeding 100 feet along with great shark activity. Whenever more than one shark was in the vicinity of the cages, they'd swim side-by-side as a way to show who was biggest and, therefore, dominant.

Something else unique about this trip was a guest onboard, Andrea "Drey" Stockert, an online video creator who was funded with a grant from the Nicholas Endowment to create a live video feed from the *Belle Amie* and from underwater inside the submersible cages that could be broadcast live to classrooms around the world. She was working with the crew and with some assistance from select people around the US who were part of a Beta test. This will, hopefully, lay the groundwork for actual live broadcasts showing school children around the world the world of the Great White Shark.

On the last day of diving, the swells from the previous day caused some cloudy, milky water from the shoreline to make its way out to where we were anchored. This milky water made shark viewing from the shallow, fixed cages near to impossible most of the morning and severely limited what could be seen from the submersible cages. This did not, however, dampen the shark activity. While down at 30' in the submersible cages, you'd be straining your eyes to see through the cloudy water and be rewarded with one, two and even three shadowy specters gliding through the haze coming within touching distance of the cages. As the morning progressed, the visibility improved to the point where you could see the two other submersible cages and the Great Whites circling them.

Besides celebrity host, Chuck Nicklin, guests had a great opportunity to talk with the onboard shark biologist Magdellana Précoma, a PhD student from Mexico, who was collecting data on Great White sharks for her dissertation. Magdellana interviewed divers after their dives to get whatever information they could share about the sharks they had seen and their behavior. She also had a chance to spend some time in the cages herself to get a first hand view of her research subjects.

On the last day of the trip, following the final morning dive in the submersible cages, diving was halted due to an issue with one of the cables responsible for lowering the cages to dept. In the event of a cable failure, each cage has a safety cable to prevent loss of a cage. There were no injuries to anyone but for safety reasons, the Captain made the correct decision to cease all cage activity, with the exception of the fixed surface cage, while the issue was investigated.

Since there was still almost five hours before the scheduled departure from Guadalupe, the Captain allowed divers to use the shallow surface cage while the crew did their best to bring sharks to the surface. It was only a matter of moments before

L-R: Mike Lever, Ed Stetson, Cindy Rhodes, Monte Rook

a 16' male Great White broke the surface with a great deal of thrashing and churning of the water. For the next two hours, the guests were treated to some rarely seen and memorable surface shark activity.

As with every HDS Great White Shark trip, guests get to spend quality time with the celebrity guest host. Each day is filled with some of the most exciting photo opportunities any of the divers ever get a chance to see along with opportunities to meet other divers with diverse backgrounds and diving experiences. Guests leave for home with memories and friendships that will last a lifetime.

HDS members on the expedition were John Binnix, Gray Clevenger, Ralph Clevenger, Giovanni DeGarimore, Dodie Duffy, Shawn Duffy, Peter Furnad, Greg Gorga, Mike Gower, Leslie Leaney, Irene Lewis, Mike Morgan, Chuck Nicklin, Roz Nicklin, Dan Orr, Melissa Pauley, Ken Reinstadler, Cindy Rhodes, Monte Rook, Tom Southwick, Andrea Stockert, David Tibbles, Bruce Wright, Johanna Wright, Robert Ziegler, Ed Stetson, Rota Ellis, Kate Johnson, Dave McCollum and Magdelena Précoma.

In 2016, the HDS will sponsor two back-to-back trips to Guadalupe Island with diving legend Ernie Brooks as the celebrity guest host. For further information contact Ed Stetson at ed@stetsondiving.com

All photos courtesy of ©Dan Orr Photo 2015

Roz and Chuck Nicklin during the lifejacket drill

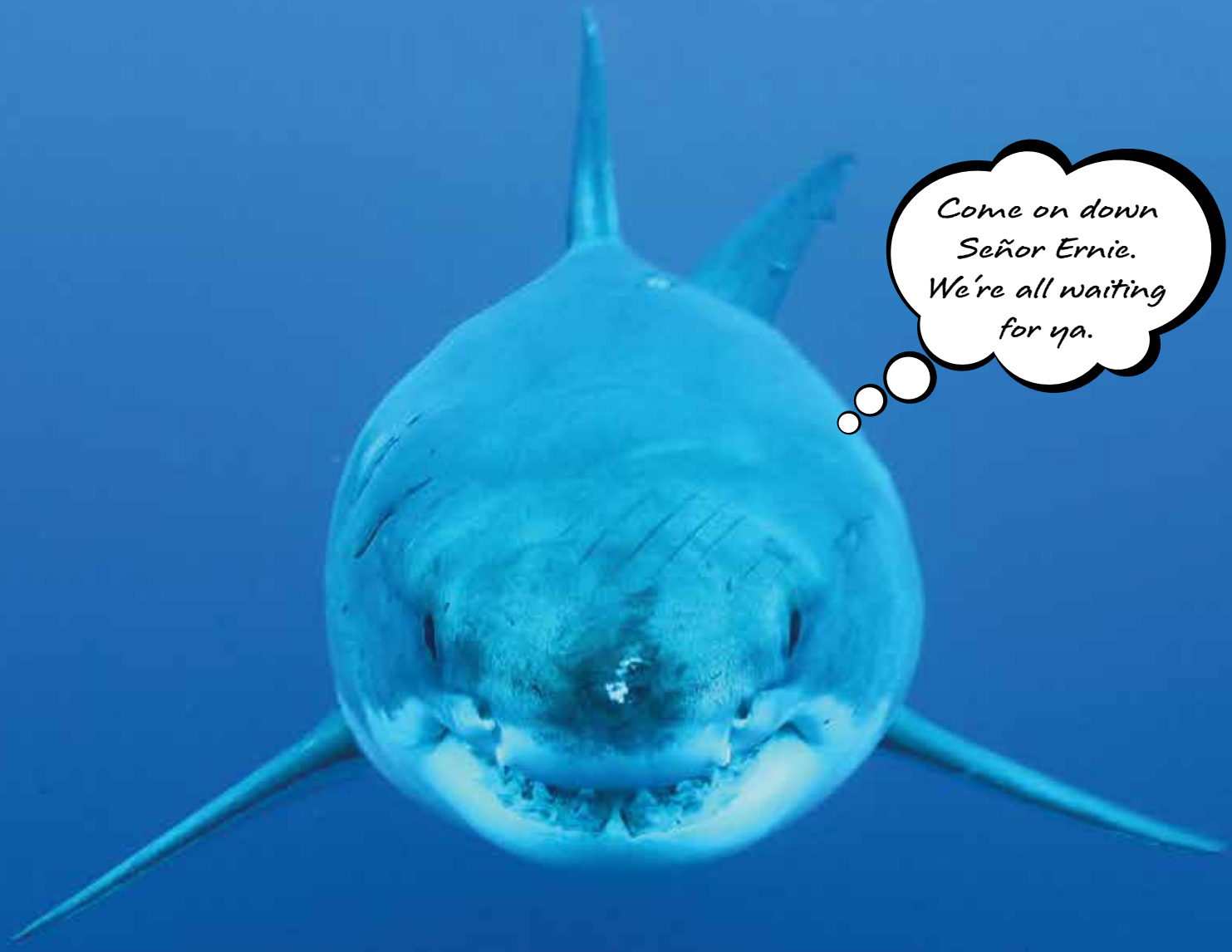
Andrea Stockert testing the underwater live video feed

10th HDS GWS

October 10-15 and 15-20, 2016

Isle de Guadalupe, Baja, Mexico

WITH SPECIAL GUEST ERNIE BROOKS II



Aboard the 140' *NAUTILUS Belle Amie* LIVEABOARD

www.NautilusExplorer.com

Guadalupe Island is located 210 miles south of the Mexican border and 100 miles out to sea. This very remote island is home to a small Mexican village of commercial lobster and abalone fisherman and a resident population of white sharks. Additional white sharks migrate through. We'll be diving in 5 cages. We've had as many as 14 different sharks in three days and as many as five sharks around the cages at one time. The water is warmer (around 70 degrees) and visibility over 100' is common. This is our 10th annual HDSGWS charter and all proceeds are donated to the Historical Diving Society. Contact Ed Stetson at Ed@StetsonDiving.com

Salvage Chief Reunion

Astoria, Oregon, February 2015

By Sid Macken

LSM 380 is beached in Guam, 1945
http://www.navsource.org/archives/10/14/101432802.jpg

Sometimes, when you least expect it, something really cool can happen. This past February, my wife and I were in Astoria, Oregon, celebrating our wedding anniversary, and while visiting an old friend, Floyd Holcom owner of Astoria Scuba and Pier 39, he said, *"Did you know the Salvage Chief is having a reunion this afternoon at the American Legion Hall?"* Not an exact quote but it covers all the important points.

The *Salvage Chief!* The ship and her exploits are legendary on the Pacific Coast and known world-wide. Commissioned in February 1945 as the *USS LSM 380,* she served in the Asiatic-Pacific Theater of war during World War II. Converted for salvage work in 1948, the ship's career in marine salvage lasted sixty years. Many of her crew, including divers, were meeting this very afternoon in Astoria, her home port.

The *Chief* was the brainchild of long-time Northwest diver Fred Devine. Fred's diving career began in 1915 in Astoria, and was chronicled in many newspapers, magazines, and books (see *Tough Country, Tough Men,* Ellis Lucia, Prentice Hall, 1963). The *Chief* was born out of Fred's frustration at not being able to pull stranded ships off the beaches of Clatsop Spit at the mouth of the Columbia River, notoriously known as the Graveyard of the Pacific. She proved her worth on her very first such attempt in 1953 and continued to do so all the way up to her retirement in 2008.

The town of Astoria is located upstream from, but within sight of, the mouth of the Columbia River. It is the oldest US community west of the Rockies, unflinchingly independent, and the center of the local fishing and shipping industries. Astoria's diving heritage predates those of the Tarpon Springs sponge divers and California's abalone industry by nearly a quarter century. Located under the Oregon end of the Megler Bridge, which spans the Columbia and connects Oregon with Washington, is a maritime memorial, which honors those residents of Astoria who were part of this rich heritage, divers included. Astorians hold their maritime history very dear to their hearts.

These two forces, the ship and the town, made this chance encounter, an event which a diving historian would be loath to miss.

As my wife and I entered the dimly lit lounge at the Astoria American Legion Hall, the first thing we saw was a room full of senior citizens sitting at tables or standing in small groups visiting. To the right of the entrance, under a glittery disco ball and amid American and military flags, were tables filled with scrap books, ship's memorabilia, and tributes to Fred, long time skipper Captain Reino Mattila, and former crew members - the "Fallen Chieftains." The "senior citizens" were the *Salvage Chief's* crewmembers, their families and friends. They had made history

The *Salvage Chief* Divers: (Right to Left) Al Stewart, Mike Johns, Jim Bay, Floyd Michels, Joe Pick, Mike Mangold (Photo by Author)

(L-R) Floyd Holcom, Mick Leitz, Mick's daughter Julie, and Sid Macken (Photo by Author)

LSM 380 anchored in San Francisco Bay, 1945-46
http://www.navsource.org/archives/10/14/101438003.jpg

Ex-*USS LSM 380* in service as the *Salvage Chief*
http://www.navsource.org/archives/10/14/101438004.jpg

and nearly one hundred of them were now gathered to celebrate it.

Spread out on several tables were scrapbooks, which chronicled the *Chief's* career beginning as a WWII landing ship medium, LSM, through her refit as a salvage ship, and her long career. Several videos which documented the ships career were also running on a TV screen located in a corner of the room next to a portrait of Fred.

Fred Devine's son-in-law, Mick Leitz, and granddaughter, Julie along with other family members were there. MIck is the embodiment of a grizzled, old salvage master and is President of Fred Devine Diving and Salvage in Portland, Oregon.

A group of *Salvage Chief* divers had gathered next to the bar. They posed for photos and started

Fred Devine dressed in to dive early in his career
(Author's collection)

Salvage Chief divers on the anchor chain of the Exxon Valdez during salvage operations

The *Salvage Chief (LSM 380)* shortly after her refit to a salvage vessel (Author's collection)

slinging stories so fast I could not keep up with them all. Unfortunately, my wife and I had a long drive home and could not stay for the dinner that evening, where I am sure more stories flowed from the memories of these remarkable men. The distinct impression I was left with though, was of a town, men, and their families, all very proud of the important role they played in the Pacific Northwest's maritime industry.

And what of the ship itself? The *Salvage Chief* was retired from active salvage work in 2008. The ship was purchased from Fred Devine Diving and Salvage in September, 2015 by the *Salvage Chief (LSM 380)* Foundation and moved to Tongue Point near Astoria, Oregon. The Foundation plans to use the ship as a memorial to its history and former crews, but beyond that the ship will continue to serve the diving and marine industries as a training vessel. The Foundation will work closely with the Tongue Point Job Corps and Clatsop Community College's Marine and Environmental Training Station to train future seafarers.

HDS President Sid Macken and Mick Leitz stand in front of the memorial to 'Fallen Chieftains' (Photo by Author)

Panels on Astoria's Maritime Memorial honor those community members who worked in various marine related occupations, from cannery workers to bar pilots. The names of many divers are included. (Photo by Author)

The Megler Bridge connecting Oregon and Washington is reflected in the marble wall of Astoria's Maritime Memorial (Photo by Author)

The Abalone King of Monterey:

"Pop" Ernest Doelter, Pioneering Japanese Fishermen & the Culinary Classic that Saved an Industry.

Written By ***Tim Thomas***
Reviewed by ***Nyle C. Monday***

Most diving historians recognize that a great deal of the diving history in the United States evolved directly or indirectly from the abalone diving industry. Many of the revered pioneers in the field got their start "picking" abalone, and then applied their hard-earned knowledge into other areas of commercial diving. In his new book, Tim Thomas examines the life and career of "Pop" Doelter, who almost singlehandedly changed abalone from an exotic food item eating primarily by Asians, into a mainstream American dish. Along the way, he helped to create the very industry to which we, as divers, owe so much.

Mr. Thomas, the author, is known to many HDS members for hosting one of our annual conferences at the Monterey Maritime Museum when he was Director there. He also has been active in the exchanges between Japan and Monterey in commemorating the achievements of Japanese living in the Monterey area beginning in the early Twentieth Century. The HDS recognized his contributions to diving history with the 2007 Nick Icorn Diving Heritage Award. Mr. Thomas has an encyclopedic knowledge of local history, and this certainly shines through in the 143 pages of this book.

The primary focus of this book is the life and career of "Pop" Ernest Doelter. Pop Ernest, as he usually was known, emigrated from Germany in 1881 at the age of seventeen. After working in various restaurants in New York, he moved on to California, where he initially worked as a waiter in San Francisco's renowned Cliff House. Soon after arriving there, he met his future wife, Vera. Vera was also a native of Germany, and Ernest gave up his job and followed her when her entertainment company relocated to Portland, Oregon. They married, and in 1891 moved back to San Francisco.

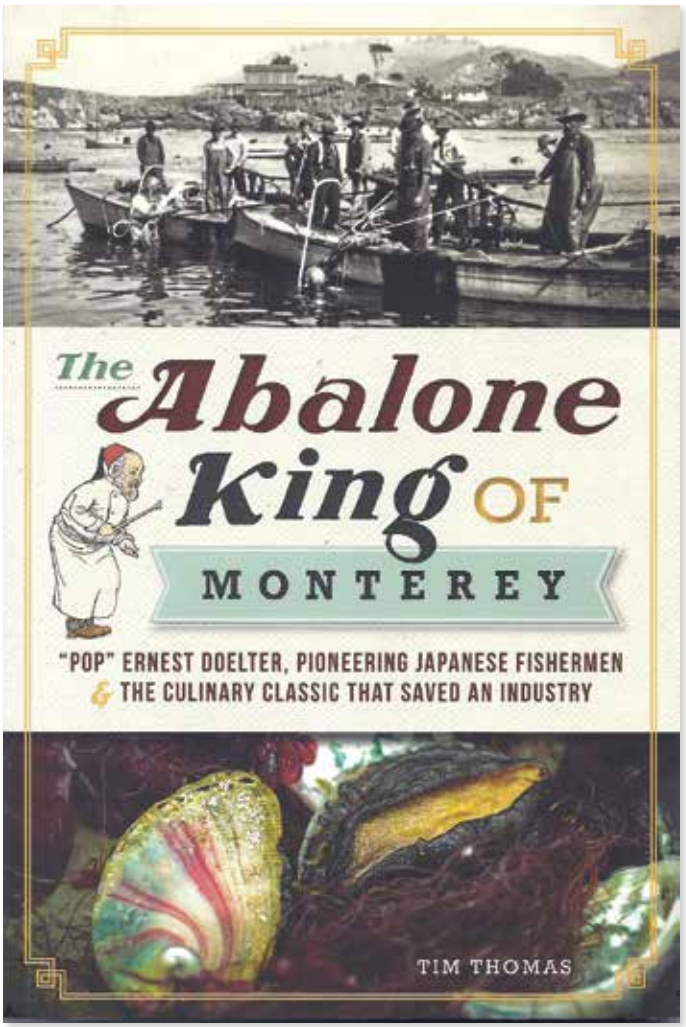
As time went on, Pop Ernest ran several restaurants of his own, eventually settling in Monterey. It was here that he first made a name for himself in applying the technique for making wiener schnitzel to the abalone, which were found in great abundance in the area. The rest, as they say, is history. Pop Ernest and his abalone recipe became an icon of the Monterey area, and of California cuisine.

Alongside the story of Pop Ernest, Thomas details the pioneering efforts of the Japanese who first harvested the abalone from deep water. The story of these pioneers is so closely entwined that it would be impossible to separate them and still tell the complete tale. The author does a fine job of conveying the efforts of two very different communities who converge in the unlikely form of a delicious food.

One of the major attractions of this 143-page, softbound book for HDS members will be the interview Thomas conducted in 1995 with Roy Hattori, the last of the Japanese abalone divers. Roy was well known to many members and was often present at the "Dive into History" rallies, which the HDS held at Whaler's Cove, near Monterey, for many years. Although Roy passed away several years ago, it is wonderful that Thomas has recorded some of his reminiscences and passed them on for us to read.

This book will inevitably be compared with Scrap Lundy's fine volume, *California Abalone Industry: A Pictorial History.* While the two books do cover some of the same history, they do so from a very different perspective. As such, Thomas' volume makes a fine supplement to Lundy's study, particularly as it further details Pop Ernest's fascinating career, and is well worth its cover price of $19.99. Be forewarned, however, that this little book is likely to cause the reader to develop a desire to taste that delectable mollusk – something which, unlike in Pop's day, can prove to be very expensive indeed.

Charleston, SC: American Palate 2014, ISBN 9781609494698, $19.99



U.S. Navy Diver Underwater Photograph

By Gary Pilecki

Since this is the year of the military diver, I have decided to show this official United States Navy photograph of a Navy diver underwater using a Mark V diving helmet. This is my first underwater photograph and one of the "newer" ones for this column. The photograph measures about 8 x 10 inches and is dated on the back December 20, 1943.

The typed description on the back states that the photograph was taken while a Navy diver is in training at Silver Springs, Florida, and that the purpose of the photograph is to promote Navy diver training films. I don't believe that Silver Springs, Florida, was a normal training site for Navy divers during World War II. Possibly this location was used for photography and motion picture training films because of the clarity of the water.

Although this is a Navy photograph, I suspect that copies were distributed to the newspaper industry as well as the general public.

More Sexton Blake

By Peter Jackson

In this issue of Cover Story, we present a few more of the Sexton Blake stories that we featured in the last issue. The actual authors of most of these tales may never be known. They were turned out in there hundreds, to the delight of young readers anxious to escape the realities of restrained British school life and immerse themselves in tales of gung-ho adventure, where the hero ALWAYS wins!

I hope you like them.

THE CASE OF THE CULTURED PEARLS, Amalgamated Press Ltd. London. Not dated

THE MYSTERY OF THE ENGRAVED SKULL by Stanton Hope. Amalgamated Press Ltd. London. Not dated

THE ADMIRAL`S SECRET, by Vincent Alsdey, Amalgamated Press Ltd. London. Not dated

THE SECRET OF THE GREEN LAGOON, Amalgamated Press Ltd. London. 1928

KESTREL`S CONSPIRACY, Amalgamated Press Ltd. London. Not dated

Cypra's Diving Helmet

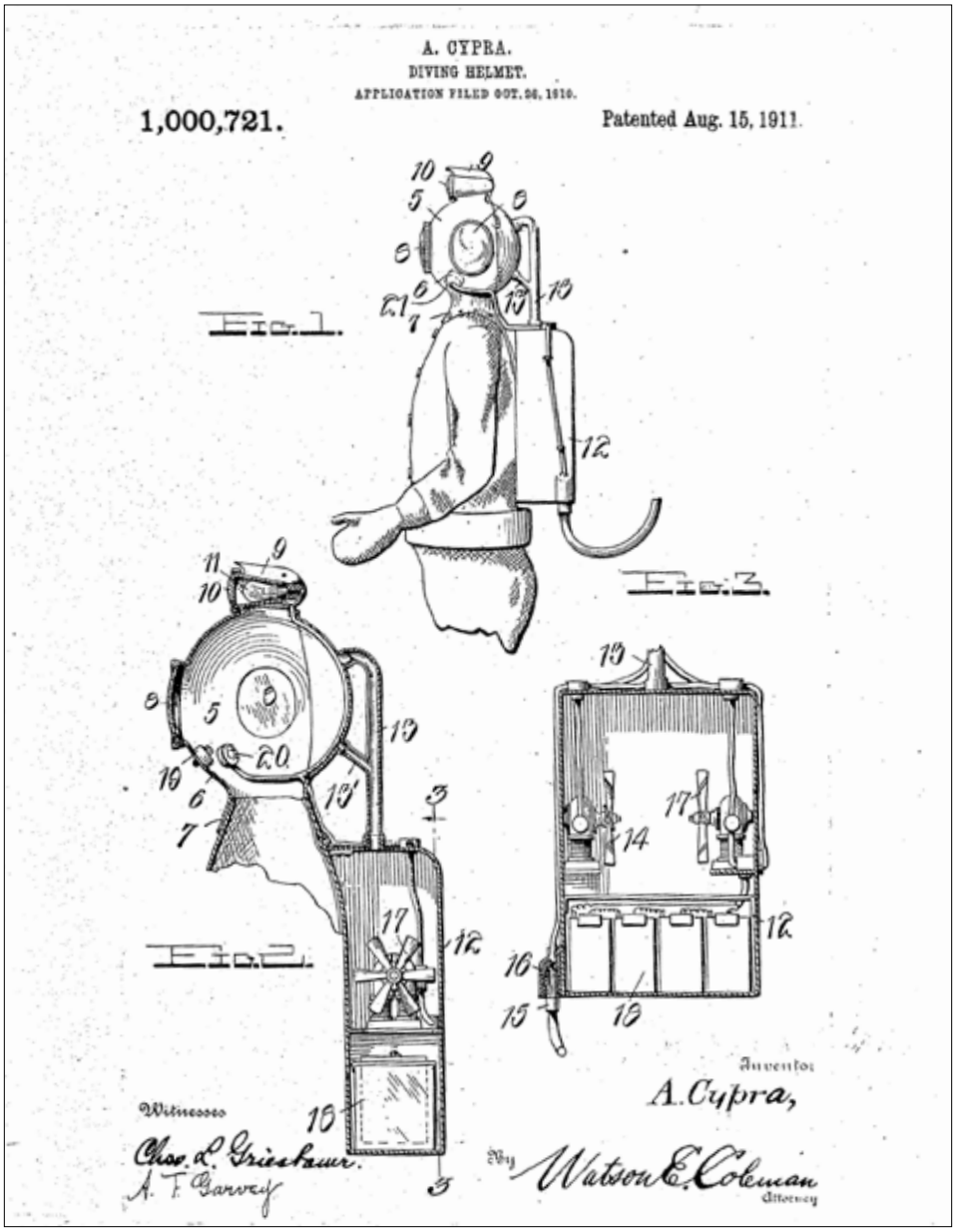
By James Vorosmarti, MD

On 26 October, 1910, Anton Cypra of Worcester, MA, filed an application 589,173 for a "Diving Helmet." Patent 1,000,721 was issued for this on 15 August, 1911. At first glance this appears to be another attempt at a self-contained diving system. However, as we shall see, it is not. The design was to "provide a device of this character which is adapted to be arranged over the head of the diver and is connected to an air supply tank carried upon his back, said tank having means arranged there for constantly supplying fresh air to the interior of the helmet."

The helmet appears to be the usual type attached to a breast plate and suit. The inventor added to the helmet top an electric light (10) and a knife (9). The knife was to be used "by the diver in defending himself against attacks of the habitués of the sea." Air was to be supplied to the diver from the tank carried on his back with air hoses 13 and 131 leading to the helmet. Hose 131 was to return air from the helmet to the tank. The tank was to be filled with compressed air on the surface. There is no indication of the volume of the tank, nor the pressure to be used. Included in the air tank were two fans to provide a continuous circulation of air to the diver. One fan, (17), was powered by batteries (18) contained in the air tank and the other (14) was to be powered from the surface through a tank penetrator (16). Fan (17) was not used under normal operations. No information is included as to under what circumstances this fan would be useful. Switch (19) in the helmet controlled this fan. Switch (20) in the helmet controlled the other fan and switch (21) controlled the electric light. These switches were designed so that the diver could operate them with his teeth. According to the narrative the fans would always provide a source of fresh air through the hose (13).

Glaring mistakes in the design are immediately obvious. Cypra neglected to provide any means through valves of pressurizing the air tank and keeping it pressurized. There are no regulators or one-way valves in the breathing circuit to regulate the flow of air through the helmet. In the system as designed, without even a shut-off valve on the air tank, as soon as the diver was dressed and the stop valve opened the air in the tank would equalize throughout the suit, as the helmet is open to the suit. The provision of the fans in no way would increase the time the diver could safely breathe the atmosphere in the system. Did Cypra actually believe that moving the air by fan would somehow increase the oxygen content? There is no reason for having any fans, one of which has an electrical supply to the surface. The capability of fighting off attacking sea-life with the helmet knife is pure fantasy. It is obvious that Cypra had no practical diving knowledge or experience.

The only other information I have found on Cypra is that he was a marathoner who ran in several Boston marathons and that he had submitted to the War Department Board of Ordnance and Fortification an idea for consideration concerning incendiary shells.



HELMET AUCTIONS

By Leslie Leaney

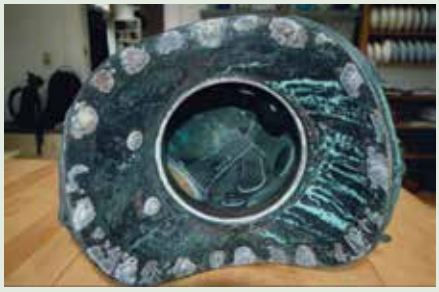
A review of recent internet auction results. While every effort is made to accurately describe the lots, vendors' opinions of what the items are, and what their condition is, are not consistent. These results are published in good faith for the interest of members, and the HDS and JoDH are not responsible for any errors in descriptions, listings, or realized prices.




DESCO USN Mark V Helium bonnet. An unusual offering of an incomplete and damaged Mark V helium helmet bonnet. The following is edited from the sellers listing: *This is an authentic vintage U.S. Navy Mark V diving helmet. It is unquestioningly the most advanced diving helmet ever designed. It was rescued from the bottom of the ocean, which created its unique patina. Nothing has been touched on the helmet. You can see by the pictures that it is missing the faceplate and breastplate. Glass is in good condition and there is a crack in one side pane. There are some dents on the rear of the helmet (photographed). This is a rare find and the fact that it is a gas helmet made and used while the Navy still dove the heavy gear makes it that much more appealing.* Located in Las Vegas, Nevada, the bonnet failed to sell as a Buy It Now listing for $7,500, but apparently did sell, as a later listing stated the item was no longer available. As it stood, the bonnet was a restoration project. The parts required to make it into a complete helmet, were a faceplate, a back canister, and a breastplate complete with straps and nuts. All these could be obtained from DESCO and, at a guess, would cost around $6,000. The bonnet has some major dents and removing them and restoring it to its original shape and condition would require some skilled metal work. At a guess, the financial investment on acquiring this bonnet, and then buying the missing parts, restoring the bonnet, and the shipping and insurances costs associated with doing all that would be around $14,000. And when done it would still be a mismatched helmet. However, that may not matter much as the market value for this style of helmet has seen a rapid increase of late, with the 1959 DESCO model featured in the Helmets Of the Deep column in this issue recently selling for $25,000.




A Miller Dunn Style 3 Divinhood in what appeared to be exceptional original condition, with almost all of its original surface coating intact apart from a small section in the center of the bulge at the back. Complete with what appeared to be the original weights and wing nuts. The helmet failed to get a bid on a requested opening bid of $3,950. The helmet was located in Florida and shipping was stated as $195.



A. Schrader's Son, Brooklyn, New York, three light commercial helmet serial number 1462. Appeared to be in sound condition with a very heavy storage patina as shown in a good series of photographs. Came with a commercial air control and whip. Sold for $5,000 Buy It Now, which seemed like a very good buy.

Morse Diving Equipment Co. Inc. US Navy Mark V, plaque serial number 802 for helmet serial number 4516, date 9/14/42. A small volume helmet with no tinning, a broken locking dumb-bell and gate, and several working dents. Appeared to be in good condition. The following is edited from the sellers listing: *This is a 73-year-old well-preserved Mark V Helmet manufactured by the Morse Diving Equipment Co. Inc. (Serial no. 802 and date 9/14/42 are clearly visible in a close-up photograph. The collar rim is engraved with no. 4516.) This item comes directly from the collection of our late father, a retired Navy submarine rescue deep sea diver. Engraved on the inside of the helmet is: US Navy, Donald F Garvin, ENC-DV, Nov 1946-1968, USS Tringa ASR-16. NOTE: (The Tringa was a submarine rescue vessel based out of Groton CT*) Sold $7,112.

By Ed LaRochelle

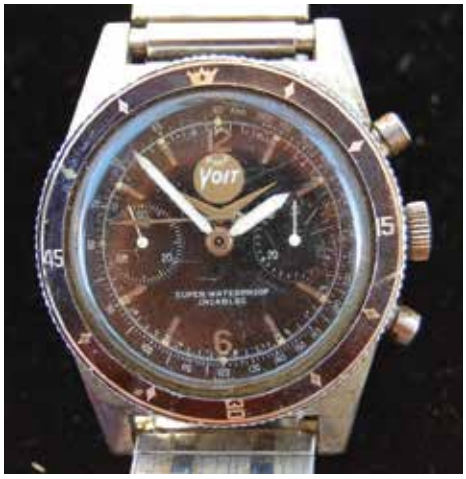
A review of recent Internet auction results. While every effort is made to accurately describe the lots, vendor's opinions of what items are, and what their condition is, are not consistent. These results are published in good faith for the interest of members, and the HDS and JoDH are not responsible for any errors in descriptions, listings, or realized prices.

KNIVES

US Divers dagger with plastic sheath, circa 1953 to 1959, cataloged as #1302. Sold for $64.

US Divers knife with plastic sheath, circa 1956 to 1959, cataloged as #1303. Sold for $80.

WATCHES



AMF Voit chronograph watch circa 1962 to 1963. This watch with the AMF dot on dial was produced for one year only in 1963. Sold for $1,333.

SPEARGUNS

Barracuda CO_2 spear gun, circa 1952 to 1955. Inventor Chuck Blakeslee placed the first ad for his gun in the first issue of The *Skin Diver* magazine in 1952. Chuck co-founded the magazine with Jim Auxier. Later in 1952 he sold the patent to Metal Formfab Co., and they made design changes to the gun. This Barracuda is the later model from Metal Formfab. Sold for $560.

US Divers SEA HUNTER CO_2 pistol, circa 1968 to 1972. With only a three-year production run, this CO_2 pistol is a very desirable item among spear gun collectors. Sold for $117.

MASKS

DESCO demand regulator scuba mask, circa 1953/54. Mask has a by-pass valve permitting air to by-pass the regulator, converting it to a free-flow mask. This feature was also used for defogging and purging. In 1955 DESCO added a purge button feature to the mask. Sold for $213.

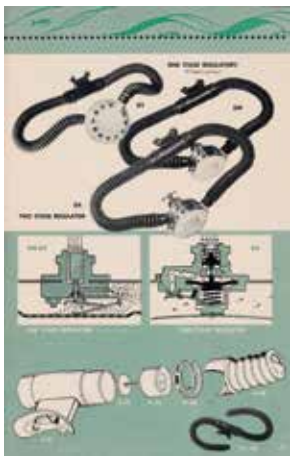
Sea Net "Sea Dive" mask with original box, circa late 1940's and well into 1950's. Sea Net Co. began manufacturing their basic model M-10 Sea Dive mask back in the 1930's at their Terminal Island, California, location. During the mid 1940's they moved to Los Angeles, California. This mask is marked with the Los Angeles address and has no band around it therefore dating it to 1940's. Sold for $164.

REGULATORS

AMF Voit Swimaster "TRIESTE," model R-22, serial number 00494,two hose regulator with original box, circa 1966 to 1969. All original with clean label, good chrome, and good hoses and mouthpiece. The box was in fair condition. Sold for $287.

Sportsways Waterlung "HYDRO-TWIN II," serial number 02735 circa 1964 to 1968. The regulator was all original and complete including the Sea View pressure gauge. The label has several missing corners and was unglued, causing it to move a bit. Chrome and hoses in good condition. Sold for $338.

US Divers DY "Jet Air," from 1956, which was the first year for this model. In complete original condition, with very clean case and cover, but the hoses were in poor condition. Sold for $213.



CAMERA AUCTIONS

By Sid Macken

A review of recent Internet auction results. While every effort is made to accurately describe the lots, vendor's opinions of what items are, and what their condition is, are not consistent. These results are published in good faith for the interest of members, and the HDS and JoDH are not responsible for any errors in descriptions, listings, or realized prices.

Aqua-Cam camera with flash, very nice condition, sold $799.

Aquatica housing for the Mamiya RZ67 Pro II camera, including twin Ikelite strobes, sold $907.

Calypso camera, high serial number, black textured paint finish, with lens cap and rare leather case, sold $650.

Soviet Krab housing for Zenit 35mm camera, sold $850.

Seahawk - Mark II housing with Argus C-3 camera, sold $1200.

Plastic housing for the Ansco A35 camera with brochure, sold $225.

Dutch Working Equipment Group meetings at Stoney Cove, England, and Lake Galder and Furieade at Maassluis Harbor, Holland.

Dutch Diving Equipment Group. *From left to right:* Terry Nash, Andre Merks, Sandy Reigersberg, Kees de Jonge, Michael Jakob, Andre Zeymer, Angela and Gabriella Neggers, Jurgen Neggers, Marcel Israel, Hans van Leeuwen, Rob Krul, Jim Bathgate, Stuart Quinn

On June 12, 2015, a small group of Dutch Working Equipment Group (DWEG) members drove to England to attend the Stoney Cove meeting. We received a very warm welcome upon our arrival and spent a great night talking with other HDS members about our shared hobby.

We spent Saturday at Stoney Cove, which is an ideal lake to do helmet diving. The DWEG members brought a complete three bolt Draeger diving set, and many local HDS members took this opportunity to try this German equipment. It was a great moment when divers in Siebe Gorman and Draeger equipment met under water. After the diving was completed we went back to the hotel and enjoyed a very nice meal while talks about our diving adventures continued. Unfortunately our visit was for only one day and we had to return to Holland on Sunday. However, the hospitality and friendship were superb and we thank everyone involved for their warm welcome.

The annual DWEG weekend, where we meet other helmet divers and exchange information, took place on September 19-20, 2015.

As usual, the diving location was Lake Galder, which is near the Belgium border, and which has an easy entry, clear water and a hard sandy bottom, enabling us to shoot some good underwater images. This year we had participants from Germany, England and Holland.

A small group met on Friday night at a nearby hotel, and activities started on Saturday with the setting up of the event shelter at the lake. After the inevitable Dutch coffee, we started the diving briefing and drew up the first days diving schedule which featured a six bolt Siebe Gorman, a three bolt Draeger, a three bolt Karl Bernardt and a 12-bolt DESCO commercial lightweight helmet with plexi-glass ports. This helmet is very similar to the helmet Bob Kirby designed in 1965. After the diving, we went back to the hotel for a good meal and a social evening with our guests. On Sunday divers used a six bolt Heinke, a three bolt Draeger and another DESCO commercial lightweight helmet, which was custom built for Jim and features abalone helmet style ports. It is a very nice helmet and it worked perfectly.

It was an excellent event and we enjoyed talking to Andre and Michael about their adventures and experiences in Germany. It was also good to talk with Jim and Stu about the DESCO helmets and to also talk with Terry about the Diving Museum. In short, we had a great weekend filled with lots of helmet diving and discussions about our mutual hobby. Next year we celebrate the 15th anniversary of the DWEG and look forward to keeping helmet diving history alive!

This year's last event was the Furieade at Maassluis Harbor and took place at October 3rd. The Furieade is named after tugboat Furie, which was the location for

Hans being dressed in the Draeger DM 220.

Marcel in the Draeger diving helmet.

a Dutch television series in the 1970's. During the Furieade, tugboats gather at Maassluis, which over its 35-year history has now become a big nautical event. The Dutch Working Equipment Group has performed helmet diving demonstrations from former salvage and diving vessel Bruinvisch (Translation: porpoise) for the last five years.

The Bruinvisch was built in 1937 for diving company "Tak's berginsgbedrijf" which later became Smit Tak, and has been restored to its former glory. During its operational years it had been in action in the Suez Canal and in the estuary of The Netherlands. The crew of the Bruinvisch supplied us with a good diving station and hundreds of visitors stood on the quay watching our operations while Hans and Kees explained what was going on during the dressing and diving. We performed seven demonstration dives with the three bolt Draeger helmet and the modern 12-bolt Draeger DM 220 helmet. It was an ideal day in which we were able to keep helmet diving history alive.

At this moment, the DWEG has no website. Nevertheless, our adventures can be followed on YouTube Channel "Dehelmduiker1" where we have posted over 400 videos about our diving operations. Beside the DWEG video's you'll find also video's about diving with shallow water helmets and standard diving gear. We hope you have fun watching us in action!

For questions, please contact Kees de Jonge at info@dutchdivinghelmets.com

Ty is being dressed for a dive in the Draeger DM 220.

Jim in one of his Desco helmets.

Kees being dressed with the Draeger suit.

Hans starts his dive in the Draeger DM 220.

Left: Fons in the Siebe helmet, right: Sandy in his Draeger helmet.

Jim dives one of his Desco helmets.

HDS USA's Helmets in History

Limited Edition Challenge Coin Series

Final Coin for 2015

U.S. Navy MK IV

With the introduction of the U.S. Navy's famous Mark V helmet, it became necessary to designate different styles of earlier helmets for identification. These designations appear in the 1916 Navy Diving Manual, where the description reads: "Interrupted screwtype: otherwise the same as Mark II," which describes the Schrader bolt helmet.

The HDS Founder's Coin

HDS Helmets in History Challenge coins are the perfect gift for the diver in your life, or as presentation gifts for achievement, speakers, or notable visitors to your company or organization. Available as single coins or annual-release sets. Some coins are now in limited supply so contact products@hds.org for availability.

2013 and 2014 still available in limited quantities as four-coin sets or individually

Individual Coins - $15
Four Coin Series - $60
Walnut Presentation Box - $25
Boxed Set - $75
Prices include US shipping. For international orders, email products@hds.org

www.hds.org • www.facebook.com/historicaldivingsociety

HISTORICAL DIVING SOCIETY USA QUARTERLY REPORT

www.hds.org

By Sid Macken, President

The annual HDS Great White Shark dive trip to Guadalupe Island in October was as usual sold-out and was well attended, both by divers and sharks. This was the second trip aboard Nautilus Explorer's new boat, the Nautilus *Belle Amie.*

The HDS ventured into new territory this past quarter by sending representatives to the Oceans 15 Conference in Washington, DC. Put on by the Marine Technology Society and IEEE Oceanic Engineering Society, the conference focused on advances in marine technology, science, education, and policy. Our main booth volunteers were Bobbie Scholley and Karin Lynn, both retired Navy diving officers and members of the Women Divers Hall of Fame, assisted by Kevin Hardy and Leslie Leaney. During the four-day event, Bobbie and Karin introduced a new audience to the HDS and brought 15 new members into the Society. Our presence at this show would not have been possible without the aid and assistance of our friend Kevin Hardy who helped introduce HDS to the workings of the MTS and IEEE.

The same week as the Oceans 15 conference, the Association of Diving Contractors International's West Coast Chapter held its annual meeting at the Santa Barbara Maritime Museum. I was honored to attend and present a history of my old alma mater, the Santa Barbara City College Marine Diving Technology Program. The SBCC program is one of the oldest continually operating commercial dive schools in the US. It opened its doors to the first class of student in 1968 and is still going strong.

I was also fortunate enough to represent the HDS at the SEALAB II 50th Anniversary Reunion in San Diego. The reunion was the idea of Kevin Hardy and was put on by the HDS and the Marine Technology Society, and drew quite a large crowd. DUI's Dick Long gave a very heartfelt talk on his early career and how he became involved with the SEALAB project. Ben Hellwarth, author of SEALAB, was the keynote speaker. Several SEALAB Aquanauts
and supporting staff, along with their families attended.

Most recently, the HDS attended the DEMA Show in Orlando, Florida. It was a successful show for us with many old friends stopping by the booth. Underwater filmmaker Chuck Nicklin, fresh from hosting the HDS GWS dive in Mexico, spent the day

Sea Lab II Aquanauts and participants pose for a photo in front of the Sea Lab II flag. L-R, Dick Long, Bob Bornholt, Keith Moore, Billy Meeks, Matthew Eggar, Bernie Campoli (hidden), Jim Osborn, Fernando Lugo, Richard Blackburn

with us on Friday to sign his new book Camera Man, the story of his career in underwater filmmaking. HDS member Ed LaRochelle has worked with the DEMA staff for the past five years putting together the Diving History Timeline and displaying items from his vast collection of vintage scuba gear. In recognition for his effort in promoting diving history, Ed received the 2015 Nick Icorn Diving Heritage Award. The Icorn Award was presented to Ed at the timeline display with DEMA staff and HDS directors attending. Booth volunteers for the DEMA show were Bob Rusnak, Ed Uditis, and Ed LaRochelle.

This rounds out a rather interesting 23rd year for the HDS. We have moved into some unfamiliar circles and made new friends. In the coming year, the plan is to continue to expand our presence at different shows. It is part of an ongoing effort to build and maintain our membership. Watch for announcements about the 2016 fundraiser after the first of the year.

Safe diving,

Photo credits by author

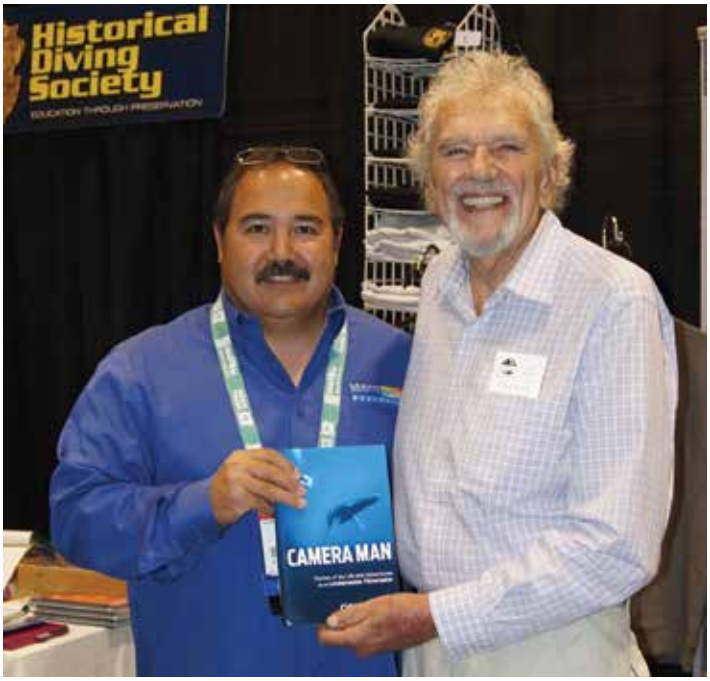
The Santa Barbara City College Marine Diving Technology Program was founded in 1968 and is still producing highly respected divers for the commercial and offshore diving industry. *Photo courtesy of SBCC MDT*

The HDS at Oceans 15 (L to R) Leslie Leaney, Karin Lynn, Bobbie Scholley, and Kevin Hardy

Bernie Campoli and Ben Hellwarth visit with Billy Meeks in the hospitality suite following the reunion.

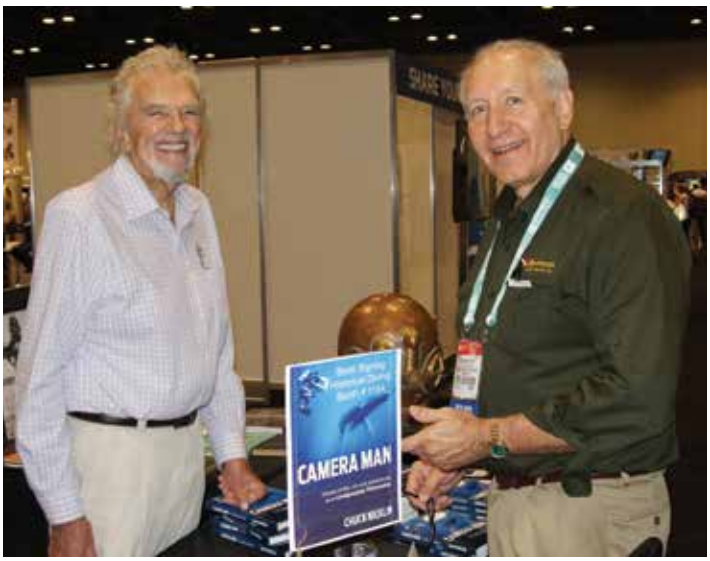
Dick Long addresses the attendees at the Sea Lab II Reunion in San Diego

The HDS booth at DEMA 2015



Floyd Holcom, Astoria Oregon, with Chuck Nicklin

Ed LaRochelle is shown receiving the HDS Nick Icorn Diving Heritage Award at the DEMA Diving History Timeline display. For the past five years, Ed has worked with DEMA to produce the Timeline and has stocked the display cases with items from his personal collection. The Timeline highlights historical diving events and technologies which correspond to decades ending in the same digit as the year of the DEMA show and draws a lot of attention from show attendees. Shown DEMA staff members and HDS Directors, Nicole Russell, Dan Orr (HDS Chairman), Sid Macken, Ed LaRochelle, Jan Raber, Ed Uditis, Laura Loomis, and Tom Ingram (DEMA Executive Director)



Chuck Nicklin and Harry Truitt, Lynnwood Washington, at the HDS booth at DEMA.

Managing Editor Bonnie Toth (L) and HDS Director Jan Raber look over the latest issue of *The Journal of Diving History* at DEMA 2015

Robert "Bob" Maloubier,

Légion d'Honneur,
Distinguished Service Order (UK), Member of the British Empire (UK)

February 2, 1923 – April 20, 2015

WWII French Special Operations Executive agent and co-founder of French Special Forces Combat Divers Unit.

Captain Robert Maloubier, British Army, S.O.E. section "F" secret agent, during WW II

Bob Maloubier was one of the last surviving French agents of the Special Operations Executive (SOE); twice parachuted into his native land, he carried out a series of daring sabotage missions with fellow agents including Violette Szabo, whom he attempted to rescue from the hands of the Gestapo. After the war he was a founder member of France's Special Forces Combat Divers Unit.

Robert Maloubier (always known as Bob) was born on February 2 1923 in Neuilly, on the outskirts of Paris. His father, Eugène, and mother, Henriette, were both former teachers who had lived and worked around the world, notably in America and England. Languages were a family gift, and later in life Bob Maloubier would speak English almost without accent. A keen sportsman, Eugène Maloubier encouraged Bob and his elder brother Jacques to pursue all forms of athletic activity, notably cycling. With the German invasion Jacques was called up into the artillery. Bob's father, then working as a press attaché for a car manufacturer, was offered two places by his company in a vehicle fleeing Paris. Bob's mother refused to leave her son behind, but the young man convinced her that he would be able to cycle out of the city quicker than they could drive. Several days later, after 400 miles, the family was reunited at Saintes, north of Bordeaux. There his father gave Bob 1,250 francs, half of what he had managed to save, and told him to flee to England and take up arms against the Germans from there.

Escape proved impossible to arrange, however, so in February 1941 Bob Maloubier joined the new army that Berlin had permitted the Vichy government to form. He was determined to be a pilot and fly to freedom, but was posted instead to ground duties in Tunisia. Only with the Allied victory in North Africa was he finally able to cross the lines. There he was introduced to an SOE officer, Jacques Vaillant de Guélis, who recruited him into the organization. From Algiers he was shipped, via Gibraltar, to Britain.

He arrived in London in early 1943, and was introduced to the head of SOE F Section, Maurice Buckmaster, before being sent to Wanborough Manor, near Guildford, which had been requisitioned by the organization. "Special Training School 5," as Wanborough was known, was designed to weed out candidates not up to the job of being parachuted behind enemy lines. Apart from training in unarmed combat, Maloubier learned to use small arms and explosives and to make radio transmissions. There were also five practice parachute drops.

At midnight one night in mid-August 1943, Maloubier was dropped into Normandy, 20 miles south of Rouen, where he became part of the Salesman network. His principal work was to train locals and receive supply drops; his cover was that he was a publicity agent called Mollier, originally from Marseille (one of several aliases), now working the region between Paris and Rouen. Passing from place to place by bicycle, staying only a night or at most a few days in farms and barns, Maloubier taught recruits how to use pistols, machine guns, grenades and explosives.

He was equipped with numerous false papers, created in London. But some were quickly shown to be useless; the paper was too thin, the color was wrong – one was even spotted as a fake by a shopkeeper. Replacements, crafted by Resistance contacts, were of a much higher quality. Fortunately, according to Maloubier, French police who carried out the vast majority of checks were friendly and their searches perfunctory. At one checkpoint Maloubier was asked: "You don't have a 7.5mm gun in that bag do you?" Maloubier replied that he did not, as his gun was of another caliber, and was waved through.

Security was much tighter, however, around the bridges of Rouen, where a 700-tonne supply vessel was moored. The boat, freshly painted after an expensive refit, had proved a thorn in the side of the British Navy, as it allowed U-boats to stay far out at sea without returning for fuel and food to inshore waters, where they were threatened by RAF attack.

The Kriegsmarine, delighted with the refit, threw a party to celebrate. Unknown to them, however, one of Maloubier's men, Hugues Paccaud, had worked on the refit. Maloubier had given him a three-kilogram explosive charge, and shortly after the German revels ended that night, the U-boat supply vessel was blown up and sank. "I came down to have a look at the damage the next day," said Maloubier. "People were joking: 'Well these Germans really are clever. Now they have underwater ships to resupply their submarines.'"

At Déville-lès-Rouen that autumn, Maloubier's crew attacked a factory producing landing gear for the German Focke-Wulf 190 fighter. "We knew that there was a guardian who could get us into the factory through his lodgings," said Maloubier. Unfortunately the guardian was absent at the time of the attack. His wife refused to let Maloubier's team in, so Maloubier adopted his best German accent and ordered her to open up. Once inside, they were guided to the heart of the factory by willing French workers. Having set their charges and made their escape, the sabotage team, numbering seven or eight, returned to the farm of another conspirator, where Maloubier triggered a celebratory feast by putting a bullet through the head of a cow.

Shortly after he had knocked out an electricity substation, on December 20 1943 he was arrested by a German patrol while on a motorcycle after curfew. None of the Germans

All photos and captions courtesy of the Philippe Rousseau Archives

Handwritten and signed personalized testimony of gratitude of the French Nation by General Charles De Gaulle – September 1, 1945

could ride the motorbike, however, so Maloubier was forced to ride it to the German headquarters with a guard riding pillion pointing a gun at his back. When they arrived, Maloubier threw his passenger to the ground and rode off, only to be hit in the ensuing gunfire.

Abandoning the bike, he made a run for it and collapsed in a freezing stream, regaining consciousness to find that the search for him had been called off. "I told myself, you're dead. Nobody gets shot in the intestines and lung and survives," he recounted. Nevertheless, at dawn he walked nine miles to a safe house in Rouen where he was tended to by Salesman's aged doctor, who visited nightly and issued a few pills to fight any infection. Maloubier did not know, however, that the doctor considered his case desperate, and the network was making plans to dispose discreetly of his body when he died. One woman was asked to stitch two potato sacks together in which the corpse would be concealed, and load it with chains so that it could be dumped in the Seine. But after eight days Maloubier was still alive. Two years after the war, he was accosted by a woman near Rouen. "You must be Bob," she said, according to Maloubier. "My dear Madame, I don't think we know each other," he replied. "On the contrary, I know you very well," she countered. "I was meant to bury you."

He was evacuated to London to complete his recovery in February 1944 – just before, in March that year, Salesman was penetrated and several of its members were arrested, disrupting its plans for pre-D-Day sabotage operations. Maloubier was parachuted back into France, this time to the Limousin, 24 hours after D-Day, to assist the Maquis. He was accompanied on the mission by Charles Staunton, the former head of the Salesman network, and Violette Szabo. But just days after their arrival Szabo was captured and imprisoned in Limoges. Staunton and Maloubier travelled to Limoges to plan a rescue operation, scheduled for June 16. Early that morning, however, Szabo was transferred to Paris. She was killed in Ravensbruck in February 1945.

In the Limousin, Maloubier's duties involved organizing and receiving supply drops from the air; at the end of June a flotilla of Flying Fortresses made one of the biggest drops of the war. Almost 1,000 containers of arms, fuel, food and banknotes helped to turn local fighters into a highly effective force. As the German grip on Limoges crumbled, Maloubier prevented reinforcements arriving by blowing up roads and bridges and was among the first forces to liberate the city. Later, in Paris, he was reunited with Buckmaster and with his family. As SOE F Section was wound up, Maloubier was transferred to the French intelligence service, known cryptically as the Direction général des études et recherches, before signing up for more behind-the-lines operations with Force 136, SOE's wing in south-east Asia. He returned to France in August 1946.

After the war he joined France's counter-intelligence service, the External Documentation and Counter-Espionage Service, or SDECE, where, in 1952, he co-founded its Special Forces unit of combat divers. He served for 15 years, in Indo-China but largely in Africa, as France's colonial empire crumbled. Among many operations, he claimed to have recruited and trained assassination teams who – in exchange for a French passport – were willing to eliminate arms traffickers supplying rebels in Algeria or the Far East. "I never executed anyone myself," he insisted later.

Ordered to organize a bombing in central Cairo during the Suez crisis, Maloubier found himself alone with the explosive after the man he had recruited for the job fled. "The problem was I had no idea how long was left before it was due to go off," he said later. "I had to drive out of Cairo, through the traffic, and bury it in the desert. It went off as I returned to the car."

Maloubier left the secret services in 1957 to work in Gabon, where he eventually trained the president's personal guard. Afterwards he did security work for oil companies in Nigeria and Liberia.

He retired at the age of 63, settling down to produce several books, written in *Boy's Own* style. These included two volumes of memoirs, *Agent Secret de Churchill* (2011) and *L'Espion aux Pieds Palmés* (2013). Hugely mustachioed, he was never shy of recounting his past in colorful terms. He was awarded the DSO in 1945. Bob Maloubier was married several times and had three children. His final marriage was to a woman 42 years younger than himself. "Not that you can tell the difference," he insisted.

Bob recently testing the new "FROGS" oxygen diving rebreather, actually in service in the French Navy for combat frogmen

Sourced and edited from *The Daily Telegraph*, *The Guardian*, and *France 24*

A Meeting with Bob Maloubier, 2011.

Churchill's 'secret agent' recounts WW II exploits.

Frenchman Robert Maloubier was an agent in Churchill's Special Operations Executive, sent behind enemy lines to rout German forces and which, unknown to many French, had a key role in the resistance.

By Devorah Lauter, reporting from Houilles, France.

Robert Maloubier likes to tell people he is a retired accountant. That he studied finance in college, that he had a quiet life, that he stopped working at 66. He can barely get the last words out without a chuckle that pulls up the ends of his bushy white mustache so it curls around his cheekbones.

"Oh, I love doing that," he says with a satisfied sigh. "Nobody knows about me here."

The truth is Maloubier, 88, never went to college. It's also hard to say whether he ever really retired, though he admits that when he turned 80 he had to stop rollerblading and flying his plane. As far as a quiet life goes, he hasn't had one and he hopes it stays that way. There are a few other things people in this quiet suburb west of Paris don't know about him: He is trained in close combat, sabotage, guerrilla tactics, parachuting and underwater warfare.

Capitaine Robert Maloubier, French Army, "S.D.E.C.E." Secret Service, French combat frogman no. 1, with a Davis British oxygen diving rebreather

Maloubier is one of the few surviving French agents from Winston Churchill's "secret army," the Special Operations Executive created in 1940 with orders to "put Europe ablaze" and defeat Nazi forces behind enemy lines. The British army awarded him the rank of captain and the Distinguished Service Order for his derring-do after he parachuted into his occupied homeland in 1943 and again in 1944. Maloubier's wartime feats include leading a band of French resistance fighters who blew up seven bridges in 24 hours to stall the advancing German army.

Nearly 70 years later, most French still don't know much about the role the British played in the resistance in their country. Most believe the wartime narrative forged by Gen. Charles de Gaulle, that the resistance was an entirely French endeavor. Until recently, there had been no major French translation of the numerous English-language books and autobiographies dealing with the Special Operations Executive. In the last few years, that has changed, and this year a French-language memoir, *"Churchill's Secret Agent,"* by Maloubier, hit bookstores. It is perhaps the only one of its kind by a Frenchman.

Maloubier writes with the fast-paced, colloquial tone of someone speaking out loud, and with a sense of humor that shrugs at death. He tells of parachuting into occupied France, of bombing a German naval vessel, of stockpiling weapons in preparation for D-Day. He writes of escaping the Nazis' clutches by pretending to be dimwittedly eager to follow instructions, a trick he learned at spy school. (As soon as the trusting SS guard gave an opening, Maloubier knocked him down, hurled a motorcycle at him and made a run for it.)

After the war, Maloubier helped train the French secret service, create the French version of the Navy SEALs and design the now-classic archetypal diving watch, the Fifty Fathoms. Swashbuckling through Africa, the Middle East and East Asia, he was a bush pilot in Gabon and worked as deputy director of an oil company.

His small house in Houilles sports abundant flowers at the front door. He enjoys reminiscing but also relishes discussion of contemporary problems. The war in Libya, he says, is "romantic," with rebels shooting wasted bullets into the sky. "We would never have been able to do that!" he says, laughing.

He worries about young people who spend their lives "lying down" in front of video screens. But he still has the optimism of the teenager who set off to fight the Nazis, and he remembers every detail as if it were yesterday. These days, he has difficulty walking and is slowed by a weak lung — damaged by an SS bullet — but he nevertheless exudes an undimmed zest for adventure.

"Modern life is about having to foresee everything: take zero risks, and live from your cradle to your grave," says Maloubier, who generally goes by Bob. "But there's nothing worse than that. Even though man wants to absolutely know what tomorrow will be made of, the excitement of life is from not knowing what tomorrow will bring. Tomorrow is another day. That's all … something different. Something will happen, must happen. Otherwise, it's going to be dull. Life can only be made of unpredictable things."

The Special Operations Executive is best known in Britain for fostering resistance in Axis-occupied areas. In France, its agents and underground French fighters held off Nazi troops and destroyed key parts of enemy infrastructure, especially in advance of the D-Day invasion. Its members also trained De Gaulle's secret service and contributed decisively to the liberation of several regions in France.

But in the minds of most French, two major groups were behind the resistance: De Gaulle's Free French Forces and French paramilitary units led by communist patriots, said historian Jean-Louis Cremieux-Brilhac, who was a member of De Gaulle's London-based provisional government. "But in reality, there was a third driving motor: the British," Cremieux-Brilhac says. "It's an idea that hasn't completely penetrated French opinion." The knowledge gap is no coincidence.

"Gen. De Gaulle insisted on affirming that France was liberated by the French themselves, with the help of the Allies, and he didn't want to

highlight the important role of the SOE," which sent about 400 agents of various nationalities to France, Cremieux-Brilhac said.

Maloubier, born in a Paris suburb and raised by French parents, would appear an unlikely Special Operations Executive candidate. When the war broke out, he was still in high school and dreamed of becoming a fighter pilot for De Gaulle. But his parents were multilingual, Anglo-Saxon-loving professors who had spent years in New York and England, and shared with their children their admiration for Churchill.

After the French surrendered to the Nazis, Maloubier's parents encouraged him to join the resistance. But he couldn't make it to London, where the resistance leadership was based, so he fled to Algeria to join Allied forces. There, he encountered an SOE agent who recruited him to join the force.

"Every Frenchman who went to fight for another army was of course completely contrary to [De Gaulle's] politics, and he was absolutely right," Maloubier says. "But at our age, we had no political clue."

After parachuting into occupied France, he trained, organized and armed French bush fighters known as "Maquis." On orders from London, they bombed a German submarine tender and an aviation gear factory, as well as numerous bridges. His men had "to be prepared for everything," he says, and played a crucial role in stockpiling British weapons dropped into France via parachute in anticipation of D-Day.

Maloubier says the underground fighters included some "nobles" but were mostly workers who had less to lose. "I was around people who were untrained, and badly trained, but they wanted to fight," he says. Their eagerness to take on the Germans wasn't enough to wash away a certain bitterness he felt after flying to London between missions. There, "everyone wanted to fight. There was a wartime climate. The atmosphere was completely different," he says. People lived in subway stations because so many homes were bombed. "But it was also very gay. People would go to nightclubs and tan in Hyde Park.... And still, there wasn't a single family that hadn't lost someone." He met "extraordinary" people there, including SOE spies such as Violette Szabo, a beautiful and skilled agent who was captured during a mission and died in a Nazi concentration camp.

Maloubier says he is driven to keep writing in order to tell their stories, collected over the years like the antiques that fill his home. Weapons from the Middle East and Asia hang on the wall of his living room, which is lighted with lamps made of 100-year-old samovars once used to brew Russian tea on the Orient Express.

"I always say that in life there is never a dull moment, and that there's always something, that…." He takes a deep breath and continues. "That makes you live again."

Cpt Bob Maloubier diving with an Italian " heavy Pirelli" oxygen rebreather set, in front of a metallic submarine net

Capitaine Robert Maloubier, French Army, diving with a "D.C. 52" semi-closed rebreather and wearing one of the very first "Fifty Fathoms Blancpain" watches

Blancpain Bids Farewell to a longtime friend, a tribute to Captain Bob Maloubier

It is with great sorrow that Manufacture Blancpain and its President & CEO, Marc A. Hayek, learned of the passing of Captain Robert "Bob" Maloubier at the age of 92. A secret agent of the British Special Operations Executive during the Second World War, Bob Maloubier parachuted into France and, subsequently into Asia. In the 1950's he was the founder and commander, together with Lieutenant Claude Riffaud, of the French military's combat diving corps. It was in this capacity that he became a part of the history of Blancpain's Fifty Fathoms watch.

For his missions, beyond his diving tanks, regulators, masks, fins and wetsuits, Maloubier and Riffaud understood the importance of having a robust and reliable diving watch. After having thoroughly tested watches which were available on the market, they came to the conclusion that none of them were suitable for the task. It was following this experience that contact was made with Jean-Jacques Fiechter, then CEO of Blancpain, who was himself a diver and passionate about the underwater world. Maloubier and Blancpain shared a common vision on the attributes of a timepiece that would be adapted to the needs of divers. Robert Maloubier describes his dealings with Blancpain thus: "Finally there was a small watch company, Blancpain, which agreed to develop our project which imagined a watch with a black dial, large numerals and clear indications using triangles, circles and squares, as well as an exterior rotating bezel mirroring the markers of the dial. We wanted at the beginning of a dive to position the bezel opposite the minute hand so as to be able to read the elapsed time. We wanted in effect that each of the markers be as clear as a guiding star for a shepherd." Fully embodying this shared vision was the first modern diving watch, named by Blancpain the "Fifty Fathoms," which debuted in 1953.

From this point on, came enduring ties between Bob Maloubier and Blancpain. In his later years, the veteran combat diver took part in many events around the world organized by Blancpain and assisted in the recent publication recounting this shared history in the reference book "Fifty Fathoms, The Dive and Watch History 1953-2013."

Member of the Legion of Honor and three times cited for the War Cross between 1939-1945, Bob Maloubier was one of the two last surviving recipients of prestigious Distinguished Service Order bestowed in 1945. In early June, the day before the ceremonies marking the 70th anniversary of the Normandy landings, he was recognized as a Member of the British Empire by Queen Elizabeth II in a ceremony held in Paris. We extend our condolences and deepest sympathy to his family and to other combat divers.

Sourced from www.blancpain.com

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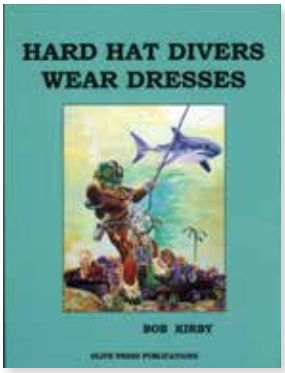

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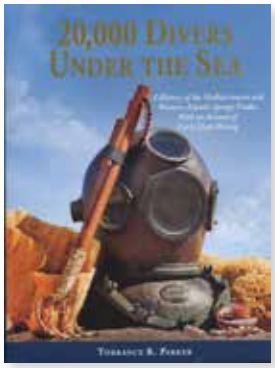

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Full book review in The Journal of Diving History, issue 75. Hardbound with color dust jacket, 247 pages, b&w photos, illustrations. Maps, index, appendix, notes, credits. Price $87. Domestic USPS Priority Mail $13 (up to 3 books to a box) USPS Media Mail $7 (1 book to a box). Contact products@hds.org for international rates.

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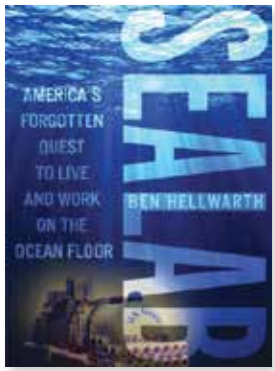

SEALAB: AMERICA'S FORGOTTEN QUEST TO LIVE AND WORK ON THE OCEAN FLOOR
BY BEN HELLWARTH
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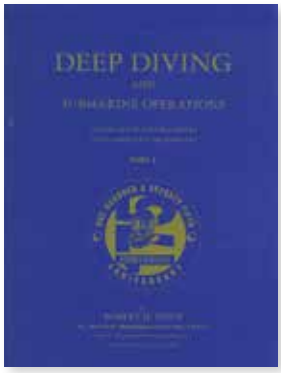

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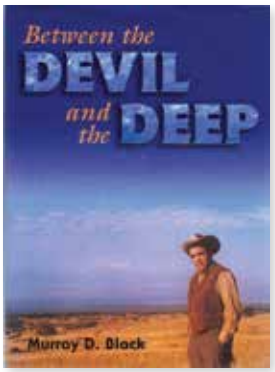

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GENESIS 1-27: "So God created man in his own image, in the image of God he created him; male and female he created them." Stan's underwater imagery set to a haunting musical score won a Gold Medal at the inaugural United Kingdom Film Festival.

A BITING KIND OF SHARK: Eighteen years after filming *Blue Water, White Death*, Stan returns to Dangerous Reef, South Australia, with famed Australian shark expert Rodney Fox to once again film the Great White Shark. They are accompanied by underwater photographers and scientists from Canada, Saudi Arabia, and the United States.

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THE WAR REEFS: In 1942, the small, South Pacific Island of Guadalcanal became the scene of a decisive, World War II, air-sea battle between the United States and Japan. It was a turning point in te war for the US and its allies, but a resounding defeat for the Japanese. The terrible cost of the battle can be found enumerated on the sea floor in what is now called Iron Bottom Sound for the scores of ships and aircraft that lie there. Stan and his companions visit the waters surrounding Guadalcanal, and as they explore Japan's sunken fleet, they discover that the debris of war has, over time, been changed, softened by the sea, and is now the home of a fantastic array of marine animals.

Volume 7 $15
PETER AND THE SHARK: Stan, Peter Benchley, and crew travel to Australia to dive with Great White Sharks. Along the way, they encounter Manta Rays, sea turtles, Bronze Whalers, Tiger Sharks on the Great Barrier Reef, and then, at Dangerous Reef, the big guys showed up. Originally aired on the American Sportsmen Show

THE CALL OF THE RUNNING TIDE: Edited for U. S. Divers from Stan's original lecture film, Call of the Running Tide documents a year that Stan and the Waterman clan spent living in the South Pacific, diving Tahiti and Bora Bora, and learning the South Pacific Islanders.

THE LAST OF THE RIGHT WHALES: Stan travels to Patagonia to search for and dive with Right Whales. These amazing, gentle creatures were hunted nearly to extinction because they were the "right" whale to bring large profits to early whalers. Stan also looks at the other creatures living along this lonely, desolate coastline.

Volume 8 $15
THE BEST OF CAYMANS: Stan visits the Cayman Islands aboard Wayne Hasson's Aggressor Fleet liveaboard dive boats. Along on the trip are Stan's good friend Peter Benchley and his family. They dive the wreck of the Ore Verde; visit Jew Fish, Barracuda, and Grouper; dive reefs, walls, and visit a shallow sand patch filled with sting rays.

THE SINAI REEFS: The best of the Red Sea, aboard the live aboard dive boat, SUN BOAT. Stan and mixed group of divers from the US visit reefs along the Sinai Peninsula, the Gulf of Eilat, Ras Muhhamad, and the Straits of Tehran. The beautiful colors of reef fish and corals endure in this film.

BELIZE - A DIVING HOLIDAY: An Aggressor Fleet trip, this time to the reefs of Belize. Day or night, the reefs are ablaze with color and the photographers on board take full advantage of the scene.

CORTEZ - THE HAMMERHEAD: Stan and Peter Benchley travel to the Espiritu Santo Seamount in the Sea of Cortez to film the massive schools of Hammerhead Sharks known to congregate there. Accompanied by shark researcher, Dr. Ted Rulison, Peter and Stan learn about the enigmatic Hammerheads and research in shark behavior.

STELLA MARIS: In another American Sportsmen episode, Stan films author Peter Benchley and Dr. Sylvia Earle as they dive with sharks at Stella Maris in the Caribbean. First dives include encounters with a large Manta Ray, and individual sharks, then the large school arrives and the dives get interesting.

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JACKI'S WORLD:The Island is Virgin Gorda, in the British Virgin islands. The subject is jacki Kilbride. Her love of the sea and devotion to protecting and sharing it make Jacki's World a very special place.

THERE'S AN EEL IN MY BC: Bonaire, diving mecca of the Caribbean, is the location for this adventure. Peter Hughes, Dee Scarr, Geri Murphy, and Paul Tzimoulis make appearances along with Stan in a comedic cameo.

A PEOPLE'S TRUST: The Bahama's National Trust, dedicated to the preservation of the Bahama's invaluable natural resources, brings education to Bahamian children and protects the island's environment through a series of parks.

CURACAO, DIVING PLUS: The Caribbean Island of Curacao, in the Netherland Antilles, is as much a delight above water as it is below. Stan takes us on a tour of this beautiful island and shows us the attractions which make it a must-dive location.

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A SIXTIETH AT *ƒ* EIGHT: Underwater photography is all the rage, and Stan takes us to class on the Bahama Island of San Salvador at the Paul Tzimoulis Underwater Photography College. Look for appearances by Paul, Geri Murphy, Peter Benchley and his family. Includes a dolphin sequence filmed by Jack McKenney.

SCUBA: A lesson in diving history, with Stan as our professor, traces the advance of man's efforts underwater from Leonardo da Vinci to Cousteau. Includes a visit to the Dacor Company and film sequences by Al Giddings and John Ernest Williamson.

SHARKS: A glimpse into the world of sharks and their relationship with humans. Incudes interviews with Dr. Don Nelson, Dr. Eugenie Clark, and Rodney Fox, plus film from of Ron and Valerie Taylor. Produced by Stan and Howard Hall as part of a World of Audobon television special.

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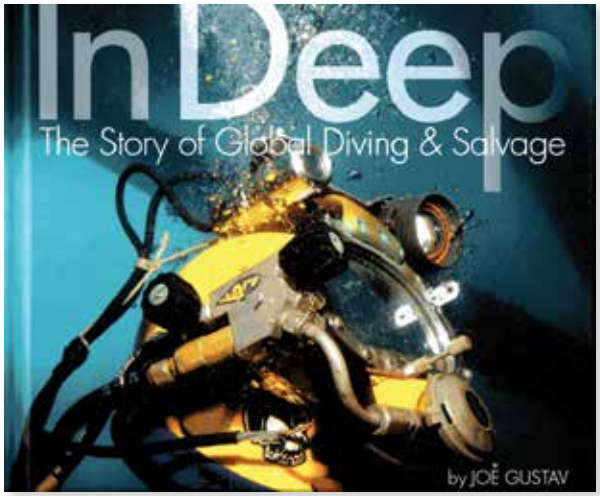

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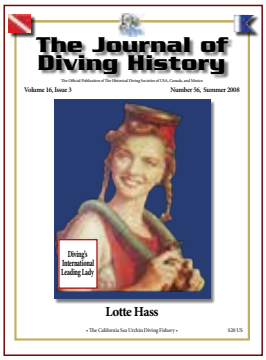

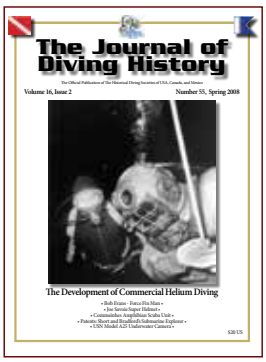

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BERRY CANNON HEADSTONE

BERRY L. CANNON

USN AQUANAUT
SEALAB II & III
MAR. 22, 1935 - FEB. 17, 1969

Berry L. Cannon was a civilian aquanaut for the US Navy's SEALAB II and III programs. A former Navy diver who had become a highly qualified electronic engineer, Berry made significant contributions to both undersea habitat experiments. Berry, unfortunately, lost his life on February 17, 1969 on the first day of undersea deployment of SEALAB III while trying to effect repairs on the habitat in 610 feet of water off San Clemente Island, California. He was just 33 years old.

Berry is buried in Florida and his grave was marked for 47 years with a simple headstone showing only his name, birth and death dates. That headstone did not reflect his achievement as a SEALAB Aquanaut. The remaining SEALAB Aquanauts joined with friends to replace the old headstone, advancing funds to replace the old marker with one that recalled Berry's accomplishments during this Golden Anniversary year of SEALAB II.

The new headstone shown below is etched with Berry's photograph and inscribed with his status as a SEALAB II and III Aquanaut. Achieving Aquanaut status was a proud moment for this father of four who served our country with distinction both as a Navy diver and again as a civilian employee.

We are still soliciting funds to pay for the new headstone, as well as provide travel funds for Berry's wife, Mary Lou, to see and touch the new marker on her husband's grave. We are approximately $1,800 shy of our goal.

The Historical Diving Society applauds this effort to correct an historic oversight and provide recognition for an individual who contributed greatly to the exploration of the undersea world.

Donations of any size are welcome. Surplus funds, if any, will be provided to the Man-in-the-Sea Museum in Berry's name to refurbish the SEALAB I habitat for display. The Man-in-the-Sea Museum is located in Panama City, FL, adjacent to the Naval Diving and Salvage Training Center (NDSTC), the home of the U.S. Navy Experimental Diving Unit (NEDU).

For further information, contact SEALAB III Aquanaut Jim Osborn at JOsborn846@aol.com. To make a donation of any size, write a check made out to "Jim Osborn" and with a notation "Berry Cannon fund", and mail it to:

Jim Osborn
9071 Havasu Street
Ventura, CA 93004

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